Bell Telephone

Hiring a Quarter of a Million Women • RAYMOND A. STEELMAN

The Bell System's Progress in Television Networks • LAURANCE G. WOODFORD, KEITH S. MCHUGH, and OLIVER E. BUCKLEY

"Service to the Nation in Peace and War" • WILLIAM H. HARRISON

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Telephones in the Post-War World • JAMES R. MCGOWAN

Bell Telephone Magazine

Autumn 1946

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"The ideal and aim of the American Telephone and Telegraph Company and its Associated Companies is a telephone service for the nation, free, so far as humanly possible, from imperfections, errors, or delays, and enabling anyone anywhere to pick up a telephone and talk to anyone else anywhere else, clearly, quickly and at a reasonable cost."

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
WALTER S. GIFFORD, *Pres.;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What

in This Issue

STUPENDOUS UNDERTAKINGS seem to be the order of the Bell System's post-war day, and among them is the important one which RAYMOND A. STEELMAN describes in this issue's first article: employing an unprecedented 250,000 women in a single year. On November 20 Mr. Steelman observed the thirtieth anniversary of his employment by the Bell Telephone Company of Pennsylvania, at Philadelphia. There and thereabouts he had charge of operating the company's cafeterias until he transferred to the A. T. and T. Company in 1923. Since then, in the traffic division of the Department of Operation and Engineering, his interests have grown from dining service and kindred matters to include the recruiting and selection of traffic employees, safety and health activities, and the personnel aspects of the development of women supervisory employees. His most recent contribution to this MAGAZINE was "Recreation Facilities for Bell System Women," in the issue for Summer 1944.

ANOTHER HUGE PROJECT became bigger still when it was announced last October that the Bell System's nation-wide coaxial cable program would be nearly doubled in extent and halved in time schedule. At that time three men familiar with the various elements of the job described to the members of the Television Broadcasters' Association the implications for that industry—LAURANCE G. WOODFORD, General Manager of the Long Lines Department of A. T. & T.; KEITH S. MCHUGH, Vice President in charge of Public Relations of A. T. & T.; and OLIVER E. BUCKLEY, President of the Bell Telephone Laboratories.

Mr. Woodford's 35-year career with the Bell System began with the Iowa Telephone Company, and continued with the Northwestern Bell Telephone Company until 1923, when he joined the A. T. and T. Company. In the O. & E. Department he progressed through the plant division until in 1941 he was appointed chief engi-

Raymond A. Steelman

Laurance G. Woodford

Keith S. McHugh

Oliver E. Buckley

William H. Harrison

Leon W. Germain

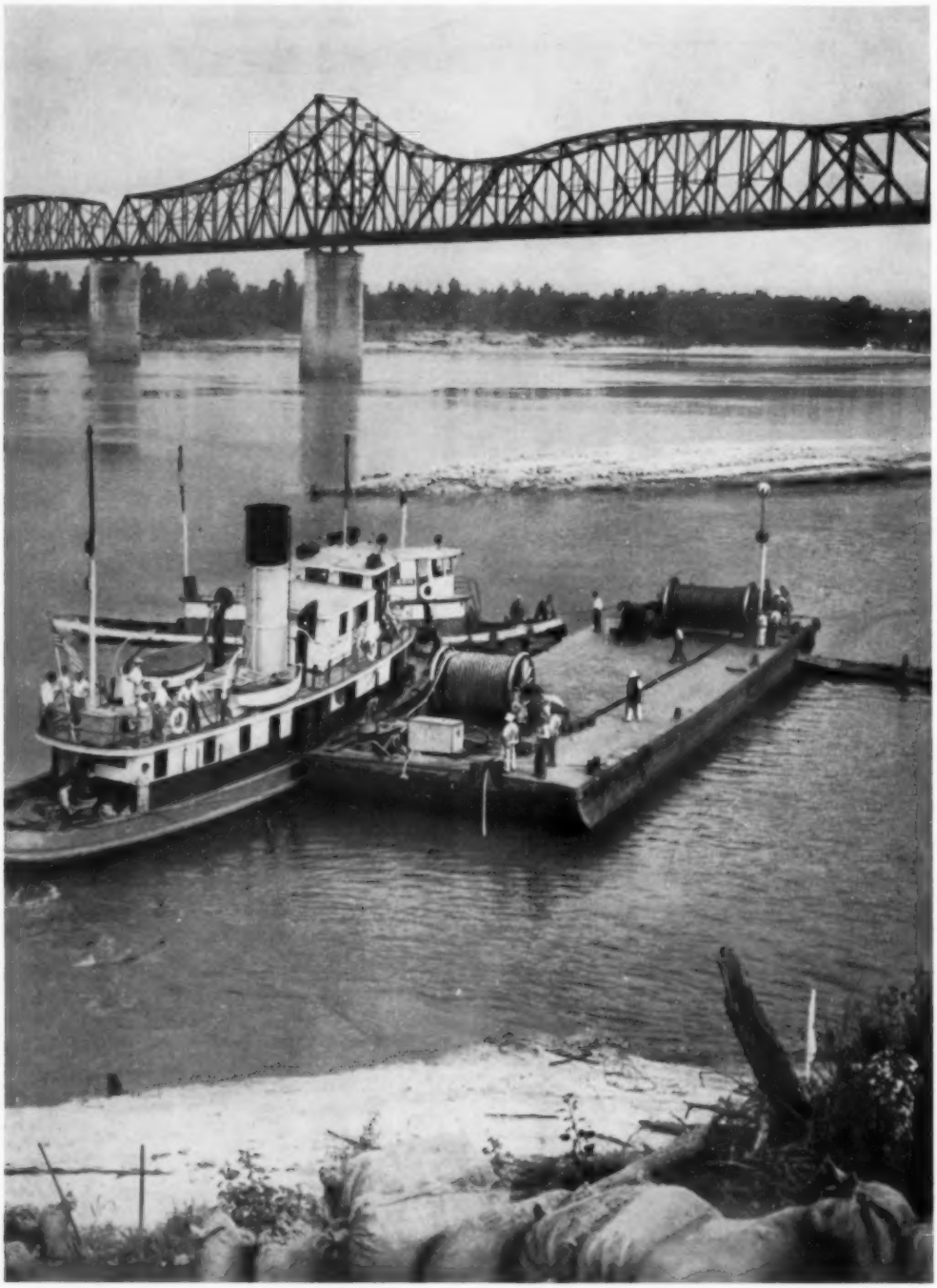
neer—the post he held until he moved on to his present Long Lines responsibility in 1943.

It was as a clerk that Mr. McHugh joined the A. T. & T. Company in 1919, but within a few months he became an engineer in the O. & E. Department. From 1921 to 1925 he was General Commercial Engineer of the Chesapeake and Potomac Telephone Company in Washington, D. C., and for the next four years he was with the New York Telephone Company as general commercial manager and as vice president. In 1929 he returned to A. T. & T. as commercial engineer, and was appointed an assistant vice president in 1934. Two years later he was elected a vice president. His appointment to the public relations position, succeeding Arthur W. Page, took place last June. Mr. McHugh contributed "War Activities of the Bell Telephone System" to this MAGAZINE for November 1942, and was one of the authors of "The Bell System's Interest in Program Television" in the issue for Spring 1944. His graceful adieu to radio broadcasting station WEAF appears on page 162 of this issue.

Dr. Buckley entered the Bell System as a research physicist in 1914. He became Bell Telephone Laboratories' assistant director of research in 1927 and director in 1933, was made executive vice president in 1936, and was elected President of the Laboratories in 1940. His "Bell Laboratories in the War," in these pages for Winter 1944–45, although written under the wraps of war-time security regulations, gives some notion of his and that organization's part in victory over the Axis powers. Dr. Buckley is a fellow of several scientific and engineering societies, and is a member of the National Academy of Sciences, the American Philosophical Society, and the National Inventors' Council.

A READING OF WILLIAM H. HARRISON'S brief talk to the Pioneers in Cleveland last October will reveal both the authority and the sympathy with which he discusses service under conditions of peace and of war. He understands both. Since he began in the telephone business as a repairman in 1909, he has worked in the New York Telephone Company, the Western Electric Company, the Bell Telephone Company of Pennsylvania and the Diamond State Telephone Company, and the American Telephone and Telegraph Company—always with increasing responsibility. From the last-named he took leave of absence in 1940 to accept heavy administrative burdens for the nation, first in civilian capacities and then as military officer; he resigned from

(Continued on page 187)



Crossing Ol' Man River: an armored section of coaxial telephone cable being laid on the river bottom near Vicksburg, Miss., as the southern transcontinental coaxial cable project pushes westward toward the Pacific coast. *See page 147*

More Than a Million People Will Have Been Interviewed During 1946 to Obtain the New Employees Needed in the Bell System's Greatest Employment Year

Hiring a Quarter of a Million Women

Raymond A. Steelman

A QUARTER OF A MILLION well qualified women to be hired in 1946: that was the requirement put up to the Bell System men and women who work in the recruiting and employment field.

The request was the largest they had ever received. To many of them the figure at first seemed fantastic. Back in 1938, before World War II began, and things were, let us say "normal," the System's needs were met by bringing in only 18,000 women. Yet the answer to the request was a quick "All right; it will be tough, but let's get going *and count on us to deliver.*" And they are doing so.

For the recruiters, the figure is even larger. For it is necessary to recruit more applicants than the number of employees required, so that proper selections can be made; and, as is to be expected, some do not accept the position offered to them. Thus it is likely that when the books for 1946 are closed, it will be found that more than a million women will have passed through the Bell System's employment offices and other points of hiring.

New people are required for many different kinds of jobs. Telephone operators comprise, of course, the largest single group of women employees: a force, with their supervisors, of nearly 250,000. And besides these, there is need for clerks who prepare and issue the bills to customers; other clerks who prepare the pay checks; typists, stenographers, and comptometer operators; and representatives who handle business office contracts with the public.

But why are so many new people still needed? The answer is enlight-

Telephone Operator

These illustrations are from a booklet entitled "An Invitation from the Telephone Company" which is distributed widely among prospective applicants

Service Representative

ening. When Japan surrendered, the Bell System was holding hundreds of thousands of orders for telephones, which, because of war shortages, it had been unable to fill. Soon after V-J Day, new telephones were being installed in an orderly rush. But the end of the war didn't bring a slackening of demands. Rather, the orders began to come in faster than ever, and the calling rate went up. So did the usage of long distance. So more employees—many more—were required to handle an unprecedented growth which the Bell System was experiencing.

That wasn't all. Because of the war, many of the employees of the telephone companies, along with those in other industries, were working overtime. The problem here was to get back to a five-day week, and that too required many additional employees.

Finally, force losses had to be reckoned with. With so many thousands of employees, substantial numbers of resignations are inevitable. They

are, of course, running at a higher rate in the hectic postwar world than in normal times.

Need for Recruiting

THERE WAS a time when more than enough well qualified girls applied voluntarily. Waiting lists were maintained and no form of recruiting was required.

Those days are gone. Now, in order to obtain the large numbers of new people who are constantly needed to keep the System ticking, they have to be recruited, and getting them is not an easy task. This can be understood when it is kept in mind that the telephone companies have to obtain their quarter of a million new employees for 1946 from the same local supply from which the needs of all other employers are filled: industries geared to produce the peacetime needs of an equipment starved nation, stores with sales volumes hitting one new peak on top of another, banks, insurance companies, transportation companies, and other employers of women.

Take a look at any want-ad page in the newspaper and see how many employers are appealing for employees. On a recent Sunday, the columns of a large metropolitan daily contained over 1900 classified ads for women, exclusive of domestic help and employment agencies. Many of these were for large numbers of employees.

To be able to obtain so many new employees, and to hold them after they are hired, requires that basic conditions be right: pay, hours, working conditions, and relationships with individual employees. Many betterments have been made, and ways to improve the attractiveness of the job are constantly under review.

Team-work Needed

TEAM-WORK is also needed. While the recruiting and employment of the System's women employees is largely a responsibility of the Traffic Departments, because it is in these departments that the large majority of the women are located, others participate actively in the work—notably the Information Departments. Throughout, the approach is that this is a Company-wide problem: one to be met by wholehearted coöperation. It is largely because of this that such excellent results have been achieved.

In a large number of communities all over the country it has been a responsibility of the chief operators and comparable supervisory employees in other departments to recruit and employ, and they have done an outstanding job. In many big cities, however, because of unusually heavy volumes, special recruiting organizations have been established. The number of new people needed and the tightness of employment conditions are two of the factors that control the exact set-up. In a typical area where 5500 additions are required this year, the recruiting organization consists of fifteen people—two men and thirteen women. This full-time recruiting organization is augmented by others who work part time on recruiting as the needs arise.

An important person is the one who heads up the recruiting program. The basic work he does and the extent to which he is able to motivate and inspire others are fundamental requirements of success. Initiative, imagination, creative ability, a back-

ground of selling experience, familiarity with departmental functioning and needs, and the ability to plan and execute an intricate program, are among the qualifications for the individual who is given this key role in the recruiting scene.

An initial step is to estimate how many people are expected to be required for each of the starting positions, for each week and month. While difficulties are experienced in making precise forecasts, it is surprising how closely experienced people can predict the needs.

Recruiting Through the Schools

IT IS through the high schools that the largest numbers of people become available as employees each year. These girls make fine employees—they learn quickly and are likely to remain in the locality.

The Bell System long ago pioneered in this form of recruiting. But when employment needs began to accelerate so rapidly, the need was crystal clear for strengthening contacts with the schools.

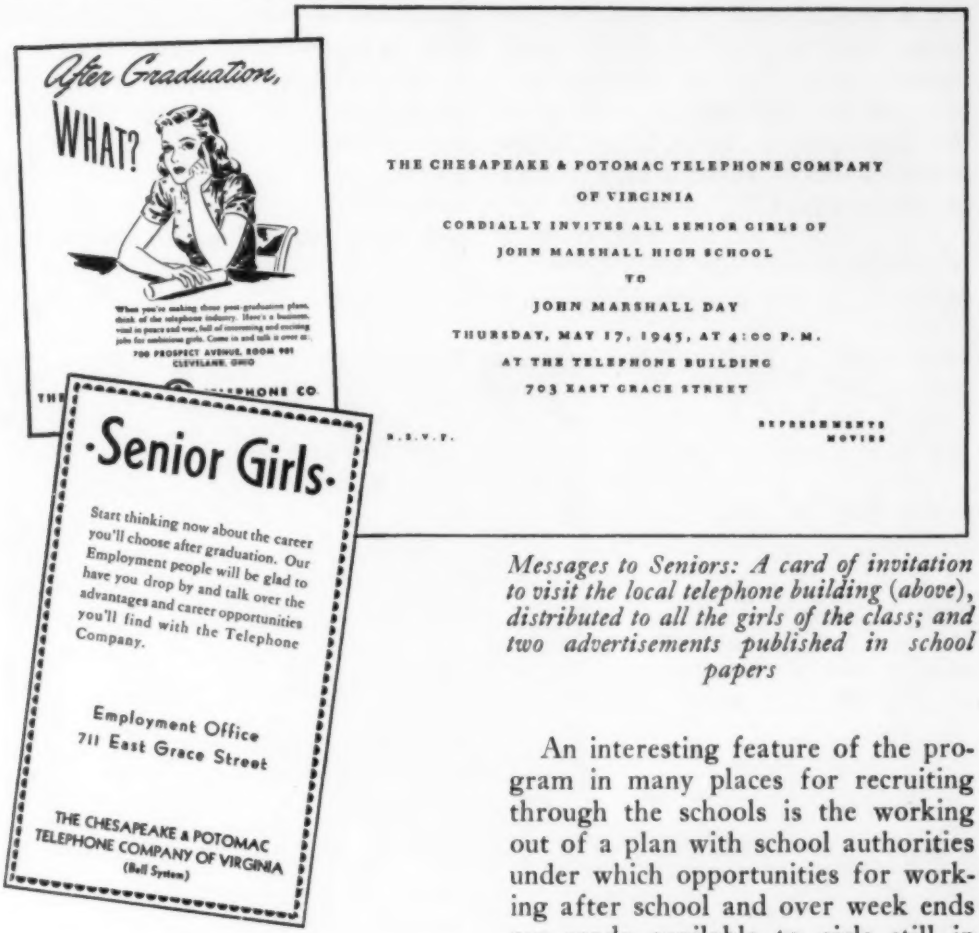
The objective now is to obtain just as many new employees as possible from this important source. Visits are first made to school officials. They naturally want their students to obtain good positions, and it is here that the excellent reputation of the telephone company as an employer is a factor of importance.

Initial contacts are followed by others with principals and counselors in the individual schools. So that principals, teachers, and counselors may have a first-hand picture of what the business has to offer, they are invited to visit the telephone building, usually in groups. Here they see the various kinds of work young women perform, and observe the working environment, the kind of supervision provided, the type of girls their students will have as associates, and the lounges, cafeterias, and other facilities provided for employees to use while not at work. Often they are guests at a dinner which is followed by short addresses and a discussion period.

So that the counselors may be able to discuss telephone company employment in specific terms with students, comprehensive reference material is provided in the form of a Counselor's Handbook, entitled *Careers in the Telephone Business*. Counselors were consulted in its preparation, and pictures are included to show the girls when jobs are discussed.

Various methods are used in attracting the students themselves. Among them are short talks in the schools by pleasant young women who are employees of the telephone company, in connection with which recruiting literature is distributed; recruiting movies, and group visits of students to telephone buildings. Many employment advertisements appear in student publications.

The movie *Step High,* a Hollywood production, was shown early this year, first to school counselors and then, with their approval, to thousands of students in schools all over the country. This picture, in a light vein, was extremely popular among young people, and was directly responsible for motivating many of the System's present employees to apply. While the operator's job is featured, all of the other beginning positions are covered, with on-the-spot scenes showing the work


After Graduation,
WHAT?
700 PROSPECT AVENUE, ROOM 901
CLEVELAND, OHIO
·Senior Girls·
Start thinking now about the career you'll choose after graduation. Our Employment people will be glad to have you drop by and talk over the advantages and career opportunities you'll find with the Telephone Company.
Employment Office
711 East Grace Street
THE CHESAPEAKE & POTOMAC TELEPHONE COMPANY OF VIRGINIA
(Bell System)
THE CHESAPEAKE & POTOMAC TELEPHONE COMPANY
OF VIRGINIA
CORDIALLY INVITES ALL SENIOR GIRLS OF
JOHN MARSHALL HIGH SCHOOL
TO
JOHN MARSHALL DAY
THURSDAY, MAY 17, 1945, AT 4:00 P. M.
AT THE TELEPHONE BUILDING
703 EAST GRACE STREET

Messages to Seniors: A card of invitation to visit the local telephone building (above), distributed to all the girls of the class; and two advertisements published in school papers

employees actually perform. Another picture to be used for recruiting purposes has just been released.

A still different activity, in which the local telephone company is simply one participant, is a school-planned college and career night, in which each college and industry represented is provided an opportunity to point out the advantages it offers, whether as a place to continue one's education or to work. At the company's booth, each visitor is given a copy of the company's recruiting booklet, an invitation to visit the employment office, and a card of introduction.

An interesting feature of the program in many places for recruiting through the schools is the working out of a plan with school authorities under which opportunities for working after school and over week ends are made available to girls still in school. Such employment, obviously, is not permitted to interfere in the least with their progress at school. Many of these girls who are seniors become full-time employees at the close of school. Others work for the telephone company during the summer, return to school in the fall, and are ready for full-time employment when they graduate.

No attempt is made to induce girls to discontinue school. The emphasis is in the other direction. In a recent radio employment program the announcer said, among other things, "That summer job may look awfully

good to you now, but chances are better than even that with a diploma tucked under your arm, you will have much better opportunities for gainful employment. If it is within the realm of the possible, I urge you to return to school."

Recruiting Through Employees

WHILE MANY girls apply for work of their own accord simply because they have friends who are employees, substantially larger numbers can be attracted when voluntary recruiting efforts are carried on among the employees on a planned basis. This method of recruiting rates high not only as to numbers but also as to quality: a company employee naturally "knows what it takes." Such

High school seniors sign the guest book as they enter the central office building for a recruiting party. Below: The mirror reports that the operator's new light-weight headset, being adjusted by a hostess, looks good on the girl who is considering what telephone operating offers as a career.

activities are participated in by all departments, although some may need few or no employees at the time. With a total of over 485,000 employees in System companies, the potentialities are great.

Bell System employees like their work—they are proud of their company and what it stands for. The "Spirit of Service," traditional among telephone operators of the past as well as of the present, is catching, and it doesn't take long as a rule for one of the operators, a "First Lady of Communications," to "sell" the idea of working for "her" company to others. Often these newcomers land at a switchboard, sometimes at another kind of work. Similarly, a prospect sent in by a Commercial Department employee may be assigned to that department, or she may take her place at a switchboard or at a desk in the Accounting Department. The employment offices try to place each employee in the kind of job she is best suited for, and the kind she would like to get.

Two methods of recruitment are used. The first is a recruiting campaign—a concentrated drive of short duration. This method is used principally when substantial numbers are required quickly. In one large city where employment conditions were very difficult a few months back, 50 "recruiters" worked full time among the employees for a four weeks' stretch. Thousands of prospects were obtained, and the names of others are still coming in.

Under the other plan, recruiting is continuous, and in the aggregate it produces the best results. It takes advantage of the fact that the employees make many new friends from time to time, and extends the recruiting plan to the new employees who are continuously entering the ranks.

Launching interdepartmental recruiting from the top, and the assumption of responsibility by all management levels, are prerequisites to its vitality and continuance. Coördination is done by interdepartmental recruiting committees, at different levels and in different localities. Among the functions of these committees are setting objectives, formulating the mechanics of the undertaking, sponsoring it in the various departments, publicity, and informing those concerned of the results achieved. Finally, the committee, on the basis of comparative performance, strengthens any weak spots that may appear in the program.

THE CRUX of this form of recruiting is the personal contact between a recruiter and each employee on the force, to the end that prospects for employment will be referred by employees to the employment office and their names given to the recruiter for purposes of follow-up. New employees, naturally, are seen soon after they start. Last June and July, in the Traffic Departments alone, nearly 40,000 young women were added to the payroll. Most of them were right out of school. By seeing these new people promptly, recruiters obtained the names of many of their friends, as yet unemployed, and large numbers of additional employees were thus acquired.

The recruiter may be an employee who works regularly on this assignment, one who has been detached from other work temporarily to recruit, or an employee who carries on

recruiting in connection with other duties. They are all carefully selected. Important qualifications are enthusiasm, ability to talk well, persistence, and enough experience to be able to answer or obtain the answers to questions that arise. Above all, they are people who feel strongly from their own experiences that their company is a fine place to work. Needless to say, recruiters are trained in recruiting methods before they see employees on this important assignment.

In contacts which the recruiter has with the employees, she furnishes material to stimulate and guide them, as well as material for the employees to give prospects—such as recruiting folders and booklets, earnings cards, and cards of introduction to the employment office. Popular for this use are book matches, lipstick tissue books, and address-telephone number books—all containing employment messages.

A typical booklet used to inform employees opens with a letter signed by the president of the company, and covers such important questions as *What Is the Employment Situation?, Why Do We Need So Many More People?, What Is Being Done to Get Them?, What Jobs Are To Be Filled?, What Are the Requirements?, What Are the Advantages for New Employees?, Where Do I Find People?, What Do I Do if I Have an Employment Prospect?* and *Where Are the Company's Employment Centers?* The book is illustrated in a light vein and much color is used.

To re-enforce the efforts of the recruiters, general publicity is given to this form of recruitment by such means as illustrated stories in company magazines, posters, lobby displays, cards for cafeteria tables, and pay-check enclosures.

Family Nights, while not distinctly recruiting activities, have aided substantially. In these affairs, popular among the employees, members of their families and others are invited to the telephone building to meet those in charge and the other employees, and to see the building, the job, and the facilities. At an employment table, suitably designated, a recruiter is present to tell the story of Bell employment, furnish printed matter, and answer questions. A common plan is for the employees to use this opportunity to give their friends who are prospective employees a close view of what the company has to offer.

INCENTIVES maintain enthusiasm. While the employees are thanked generously for their aid by people in the organization who are close to them, other methods are also used. These include a recruiting news sheet —*Recruit-her*—for example, which publicizes the results by groups and gives the names of participating employees, and an honor roll posted in the office. A novel idea is the chain poster, which features the photograph and name of the employee who recommended the new employee, followed by the photographs and names of all other new employees added to the force as a result of hiring the original girl.

Other activities are informal luncheons at which participating employees are entertained, and the recruiting dance—for which employees qualify through participation in the recruit-

High school students, visiting a telephone building, take part in the company's "Teen and Twenty Time" radio program, one of its many recruiting activities. Right: A "still" from the Bell System's Hollywood movie "Step High"

ing plan. At one such dance, which was preceded by a well planned campaign involving bulletin board posters, booster handouts, and easel displays, the ballroom of a large hotel was engaged. In attendance were 640 employees and their guests. Many additional employees were acquired as a result of the campaign, while stimulation was given to the entire program of recruiting through the employees.

Making Our Needs Known

THE PLACE to which most people go when they are seeking employment is the want-ad section of the newspaper. Here the approach is direct—the kinds of positions open are stated, and the advantages are described completely and attractively. Striking captions are used and in many cases pay is highlighted. While telephone company pay is good, many do not know it. Putting money in the ads has been responsible not only for attracting applicants—it's what they want to know—but it has a public relations value as well.

Display advertisements are also used. While direct appeals in such advertisements are not ordinarily as immediately productive as in classified ads, display advertisements permit stating the company's needs for people more completely and dramatically than space on the want-ad page permits, and to a large audience.

One of the principal uses of display advertisements in newspapers and also in magazines is in connection with long range programs aimed at establishing in the minds of the public, and of young women in particular, the attractiveness of the telephone business as a place of employment.

FEATURED in all types of recruiting publicity are those things which young women want in a job which the telephone company has to offer. Included, in addition to good pay, are convenient places of employment, interesting work, competent and friendly supervision, congenial associates, pleasant surroundings, opportunities to get ahead, and job stability. Many excellent ideas have been obtained from the employees themselves. In a contest, *What Would You Tell Mary?,* Mary being a girl who soon may be considering taking a job, 900 entries were received from the employees of all departments of one company. The contest was announced in the company magazine, entry blanks were included, and substantial prizes were awarded the winners.

Radio is used in two principal ways. Where other methods do not produce enough applicants to permit filling the need, it is used in the same way as the classified ad—to attract applicants at the time. Its other use is to assist in establishing in the public mind, over a period of time, the fact that the telephone company is a good place to work.

Among the well established telephone employment programs which have a big following among young people locally are *Teen and Twenty Time, Serenade for Smoothies,* and *The High School Hour.* A feature of one of the regular programs, broadcast on Saturday nights, is a salute to the high school whose team was the winner in a local football game of importance that day. Another features fan mail from girls' clubs, along with a weekly studio party, in which nationally known guest stars, popular among young people, appear in person. Another dramatizes incidents in the lives of telephone operators, parts being taken by high school students whose names are announced.

Additional forms of radio employment advertising include interviews with employees and spot announcements, while recruiting messages are often included in programs that contain diversified commercials. Specific wage information is given in many of the announcements.

A recruiting campaign, to be fully effective, must be comprehensive in scope. Thus, while relying heavily on recruiting through the schools and present employees, together with the use of the newspapers and the radio, the total picture, where recruiting is difficult, includes supplementary media such as window displays, displays and posters in lobbies of telephone buildings used by the public, street car and bus cards, cards on company vehicles, contacts with the public in business offices by specially selected and trained recruiters, and in extreme cases door-to-door canvassing.

Bringing Back Former Employees

MANY EMPLOYEES who resign from the telephone company do so not because of any dissatisfaction with the job; marriage, home conditions,

"I'm so glad Jane's going to work for the TELEPHONE COMPANY"
It's a nice feeling for a mother to know that her daughter is working in safe, wholesome and congenial surroundings.
Here at the Telephone Company, young girls can be sure of these pleasant working conditions besides good pay, interesting public service and opportunities for regular advancement.
Why not suggest that your daughter talk things over with us today.
Act at once. You may telephone to inquire about
and 11 P.M.
1000.
Boston
Young Women:
we need more people just like YOU!
Recommend a friend
Turn in her name to your Supervisor NOW!
Your HELP WANTED
Introduction Card
THE OHIO BELL TELEPHONE COMPANY
WOMEN'S EMPLOYMENT OFFICE
700 Prospect Ave. Room 901
will introduce
would like to make application for employment with our company.
has been referred by
office.
Women's Employment Office
I have referred to you
as a prospective applicant for telephone employment. Her telephone number is
NAME
DATE
EMPLOYMENT OFFICE COPY

A newspaper display advertisement (top). A poster, a booklet, and a referral card, all designed to enlist the help of present employees in interesting their friends in telephone work

and leaving town are some of the common causes. There is thus the always present possibility that substantial numbers of former employees might like to return, either in the same location or in a different place to which they have moved. Many of these people are experienced, and being able to utilize that experience is something worth striving for. In tapping this supply, there is a systematic program for keeping in touch with former employees, and many do return. When basic changes are made, in wages for example, former employees are promptly informed. Some of the newspaper advertisements and radio commercials are beamed solely at them.

There is always a certain amount of moving around from city to city. To care for this, transfer procedures have long been established. In recent years there has been more of this than normally, and to insure that experienced employees will be "saved" for the System, if possible, information is sent

to the proper supervisory people in the new location, giving the details regarding employees who move, whether within the same company or to the territory of another company. This permits reaching them directly if they do not apply for work.

Employment Offices

FOR YEARS the System companies have had employment offices for women in all cities where the size warrants them. All applicants go to these centers, regardless of the kind of position desired. Large volume hiring has necessitated the opening of many additional offices and the expansion of others. Paralleling the expansion of these facilities has been the addition of many new interviewers and other employment office personnel. These carefully selected women are prepared for their work on the basis of a recently developed training course, geared to meet the needs of present-day employment conditions. Where there are no employment offices as such, designated supervisory employees have the employment responsibility.

Induction and Training

AFTER EMPLOYMENT come induction and training. Induction procedures are aimed at establishing and main-

An Interesting Job
at Good Pay
This folder shows your earnings as a telephone operator during the first two years in the telephone company.
A Good Place for a Girl to Work

Booklets which emphasize the advantages, financial and environmental, of telephone employment

taining pleasant contacts between supervision and the new employee from the very start, and giving information promptly to her about the many things she wants to know and those with which the company, as her employer, wants her to be familiar. Movies are used as one of the ways in which interesting stories are told. Titles of two such pictures recently completed are *The Big Day* and *Meet Your Company*.

Another activity is popularly referred to as *The ABC's of Our Business*. In this, new employees—and older ones too—in group meetings are given information about fundamental principles applying to the successful running of any business, and the telephone business in particular. Sound-slide films are used, trained leaders conduct discussion periods, and booklets are distributed as take-home pieces.

IN PREPARING the new employees to perform their work, and keeping pace with the current heavy intake, training forces have been substantially augmented, new training facilities provided, and improved training methods introduced. A recently released movie, *Emily Talks Training*, illustrates vividly for instructors the principles of carrying on training discussions with operators.

Recruiting activities:—Left, a "recruiter" discussing with an employee the possibility that some of her friends might be interested in telephone work. In circle, a switchboard scene from the new Bell System film "Emily Talks Training." Below, the men who guide a recruiting program—a general staff interdepartmental recruiting committee

Part of a telephone company employment office in a big city

Looking Ahead

BY NOW the System's employment program for 1946 is well along towards completion. In retrospect, the hiring, training, and assimilating of a quarter of a million women in but one year represents, in the minds of many, one of the greatest recent accomplishments of the Bell System.

But employment people must always be looking ahead, and in the foreseeable future large scale activities will surely continue. The size of the force will have to be increased still further, force losses are continuing at a substantial rate, and the employment situation is tightening in many places. And so, in getting ready for 1947, three regional conferences on recruiting and employment, in which every Bell Company was represented, were recently held in Washington, Chicago, and San Francisco. The discussions were thorough-going, and growing out of these meetings is the confidence that no matter what the future needs may prove to be, nor how difficult the obtaining of employees may become, the men and women who carry the responsibility will find ways to insure that the problem will be solved.

About 2,700 Route Miles of Coaxial Cable Are Now in Place, and the Installation Schedule Has Been Speeded Up to a Rate of 3,000 Miles Next Year

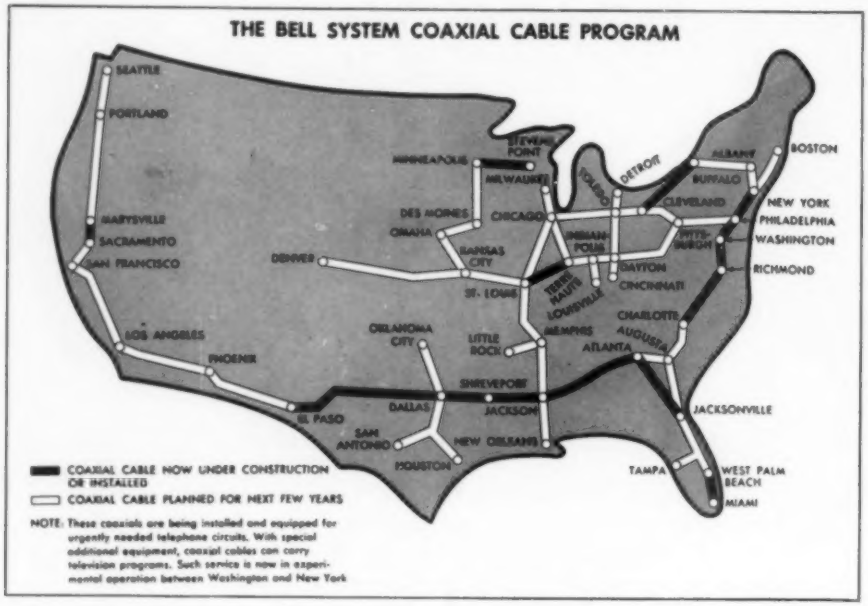
The Bell System's Progress in Television Networks

Editors' note: Important announcements concerning the Bell System's transmission facilities for the television industry were made at the second Television Conference of the Television Broadcasters' Association, held in New York on October 10 and 11, by Laurance G. Woodford, General Manager of the Long Lines Department, Keith S. McHugh, Vice President of the American Telephone and Telegraph Company, and Oliver E. Buckley, President of Bell Telephone Laboratories. Mr. McHugh and Mr. Buckley spoke in connection with their acceptance, on behalf of their colleagues, of gold medals presented by the Association; and Mr. Woodford's was the principal address of the second day's session. The substance of their remarks follows:

I. *Laurance G. Woodford*

EARLY IN 1944, the American Telephone and Telegraph Company announced a five- to six-year construction program involving 7,000 route miles of coaxial cable. That program is now being compressed into about three years, and additional routes have been added to the enlarged program, so that by about 1950 we expect to have some 12,000 route miles of this broad band cable in service.

As of October 1, about 2,700 miles of coaxial cable were in the ground, and construction is moving forward rapidly at a rate which will approach 3,000 miles next year. Right now, cable plow trains on the southern transcontinental route are laying cable between Jackson, Miss., and Shreveport, Louisiana, and are operating as



The 12,000 route miles—installed, under construction, or planned—comprising the Bell System's nation-wide coaxial cable program which is scheduled for completion by about 1950

far west as El Paso. Other trains are placing cable between Buffalo and Cleveland.

Coaxial cable is tailor-made to fit the requirements of each type of terrain. Through cities it is placed in conduit; through areas subject to frequent electrical storms, it is enclosed in a special copper jacketing; through particularly rugged sections where rocks and boulders are encountered, and in crossing streams, a protective armor covering is used.

The coaxial "tubes" first used in 1936 were about a quarter of an inch in diameter. Because of the wider frequency bands now contemplated, the diameter of the tubes now being put into the cables has been increased to three-eighths of an inch. These larger tubes permit us to station the auxiliary repeaters eight miles apart, instead of five and a half miles, and to put the main repeater stations as much as 150 miles apart, as compared to 90 miles in the case of the earlier cables. The repeaters, as you know, make up for the weakening of the signal in passing over the cable. Toward the end of an eight-mile section, the strength of the signal may be only a hundred-thousandth as great as it was at the beginning of the section. Most of the auxiliary repeaters are in small unattended buildings which are visited only in case of trouble and for periodic routine tests.

Safeguarding Operation

STEPS which have been taken to insure continuous and satisfactory operation are particularly interesting. You know perhaps that coaxial cables contain special pairs of wires, in addition to the actual coaxial tubes,

which help us to do the maintenance job. Continuous information as to the operation of the equipment in the auxiliary repeater stations is sent automatically over these wires to the main repeater stations. A change in the signal strength at any repeater may indicate a weakening of that link in the chain. Such an occurrence is immediately made known to attendants, even though they may be miles away. This permits potentially weak apparatus to be replaced before a failure can occur.

As a further precaution to insure continuous service, each repeater has a double set of vacuum tubes, so that failure of a single vacuum tube will not cause an interruption.

Power for operating the repeaters is supplied from commercial sources through connections at the main repeater stations. Here again careful precautions are taken to prevent interruption of service. Large storage batteries and engine-driven generators are provided for emergency use. Power for the auxiliary repeaters is transmitted from the main stations over the central conductors of the coaxial tubes themselves.

In television transmission, each frequency component in the broad band required must travel over the circuit at the exact speed of every other frequency in the band. We know that if some frequencies arrive at a distant point a millionth of a second later than the other frequencies, the picture will appear quite fuzzy. Our precision job in this respect has been to develop apparatus which makes extremely accurate adjustments in the time of travel as between frequencies. The frequencies on the outer edge of the band have a tendency to move just a little more slowly than those nearer the center.

Mr. Woodford points out the southern transcontinental route

This means that certain frequencies must be *slowed up* to permit other frequencies to *catch up*. For the sake of comparison, just imagine two trains in a coast-to-coast race reaching the finish line less than a train-length apart.

Coaxial Cables and Micro-wave Radio Relay Systems

IT HAS BEEN our view that coaxial cables are fairly certain to play a prominent role in network television transmission. Their reliability, the fact that the Bell System is constructing a network of coaxial cables for telephone usage between the principal cities of the nation, and the expectation that further developments will make it possible to provide both telephone and television channels over the same coaxial conductors, all make the coaxial seem an attractive type of facility for television network use.

We are not placing our reliance solely on coaxial cable, however. The Bell Telephone Laboratories are also conducting extensive development work on radio relay systems. One such system is now being installed between New York and Boston and is expected to be available for experimental use next spring. Should radio relay systems prove advantageous for use either alone or in conjunction with coaxial cables, they will, of course, be utilized where indicated.

Thus far we have been speaking only of facilities for inter-city network transmission. These would appear to be of first importance because of the economics of network broadcasting and because of the urge there will be to bring events of national interest to all important centers of population. But local facilities also are a necessity to the broadcaster, and the Bell Laboratories have made progress in developing arrangements for this purpose as well.

For studio-transmitter links—where a permanent, reliable, high-grade facility is required—coaxial cable already has been provided in a number of cases and we are now experimenting with a type of specially shielded balanced cable pair which we believe will be even better suited to this purpose in many situations.

For carrying programs from remote pick-up points to the broadcasters' control rooms, we have developed both radio and wire methods; in fact, facilities of both types are in use for bringing programs to this conference.

It has been found that ordinary telephone wires can be used for this purpose when special amplifying and equalizing equipment is provided and the wires are cleared of all branching connections. This method has the great advantage that the wires already exist to most all points of interest.

Micro-wave radio links may be better adapted for local pick-up facilities where "line-of-sight" locations can be found for the transmitter and the receiver. In short, it appears to us that both wire and radio facilities will have fields of use for local pick-ups.

OUR PLANS for future construction are based primarily on our need for coaxial facilities for telephone service. Since these facilities will be provided to take care of growth over a reasonable period of years, we expect to have spare coaxials on almost all

of these routes, which can be used for television transmission until more facilities become available. Such use for television, however, requires special terminal and line equipment and other arrangements over and above those required for telephone service.

We expect the embryonic network which now connects this city and Washington with two-way television facilities to be extended to Boston next year, using radio relay. We expect also to make available two additional one-way television circuits between New York and Washington next year. In 1947 we will push westward towards Pittsburgh, and hope to be able to connect such cities as Cleveland, Buffalo, Detroit, Chicago, and St. Louis by the end of 1948 or shortly thereafter. Other cities in this general area probably can be connected not much later than this.

In addition, we expect the southern transcontinental route through Washington, Atlanta, Dallas, El Paso and on to Los Angeles to be completed by the end of 1947, as well as an extension along the Atlantic seaboard to Miami. This does not mean that a coast-to-coast television circuit will be available by that time, although the basic coaxial facilities will be installed and operating for telephone service.

Anticipating Television's Expansion

ONE ASPECT of the situation which we expect will be present for the next couple of years is that the number of television network facilities we can make available between these major cities generally will be limited to one in each direction. This means that the several broadcasters may have to share in the use of these networks.

As soon as we can catch up with the demand for telephone circuits or the development of new equipment can be completed—for example, a new type of repeater which will permit us to transmit telephone and television simultaneously on the same coaxial conductors—this sharing can be eliminated. We will endeavor to provide for your individual service needs as rapidly as possible.

Local television facilities for use in picking up programs, as some of you know, have been provided by the Bell companies to supply most of the service requests which have arisen to date. Since the war we have furnished more than twenty such facilities to various broadcasting stations. Both radio and wire arrangements have been used successfully. The development and manufacture of the necessary equipment is being pushed, and next year we expect to be in a position to provide over one hundred of these pick-up facilities.

We have already indicated, to some of you at least, that television network rates necessarily will be considerably higher than those for sound broadcast network service. This is mainly due to the fact that the transmitting facility required is one which otherwise could be used to provide a great many telephone circuits—a fact which is readily apparent when one considers the relative widths of the frequency bands required for television and telephone circuits. Nevertheless, we believe we can make rates for network service low enough to be attractive to the television industry, and hence look forward to a rapid expansion of the industry in which we will be participtants.

II. *Keith S. McHugh*

AS LONG AGO as April 7, 1927, President Hoover and Mr. Gifford, the president of our company, were the principals in a demonstration of television over a special wire circuit from Washington to New York. On the same day, a television program was sent by radio from Whippany, New Jersey, to a station here in New York. The first public demonstration of color television was given on June 27, 1929, here in New York. And in April, 1930, two-way television was demonstrated publicly between our building at 195 Broadway and the Bell Telephone Laboratories at 463 West Street. This pioneer work helped make possible the developments of today.

Two-way television service is being given between New York and Washington without charge to the industry during an experimental period, and two additional one-way circuits will be available over this route next year.

Next year we also expect to complete for trial the New York-Boston radio relay link which will tie into the coaxial cable system at New York. We expect this relay link to afford comparisons with the coaxial cable of great value as to relative quality of transmission, flexibility, reliability, and costs.

We have also been doing much in the way of experimenting with short links for local pick-up purposes and for short legs off the main networks, using both radio and wire facilities. These show promise equal to that of the longer main networks.

I cannot refrain tonight from comparing this occasion with the early days of broadcasting. I had the good fortune personally to be rather closely associated with those days, as I was the general manager of one of the two Bell System broadcasting stations —Station WCAP at Washington. I participated in the early trials and tribulations of studio design and program techniques, sold one of the earliest commercial contracts to a sponsor, had the usual difficulties with performers both amateurs and professionals, and worked closely with the first general network transmissions, which at the start included all of two stations. Those few years had many headaches, but were of wonderful interest. I have never lost this interest in the industry, even though the Bell System companies shortly disposed of the stations and confined themselves to the business of transmission of programs. Today we are furnishing 135,000 miles of program channels.

MANY OF YOU will remember those days when we used cat-whisker receiving sets costing a few dollars, and when almost anyone—if he scurried around diligently—could build a five-watt broadcasting station for a few thousand dollars. Perhaps the dollar risks were not very great; but it was from those modest beginnings that a great industry has grown—an industry which gives employment to thousands of men and women and which brings education, information, and entertainment to millions of American homes.

Today, while our techniques and our knowledge are enormously ad-

vanced over those days, the risks to the entrepreneurs are very great. I do not know what a modern television station and studio will cost, but it will be many-fold that of the investment in the first broadcasting stations. I do not know what the set manufacturer must risk in our highly competitive and fast-changing markets, but it must be very large compared with that of the set manufacturer in 1922. The networks and the motion picture people must necessarily be contemplating extensive outlays in experimenting with programs, films, and the equipment and techniques necessary to make this infant industry grow to lusty manhood.

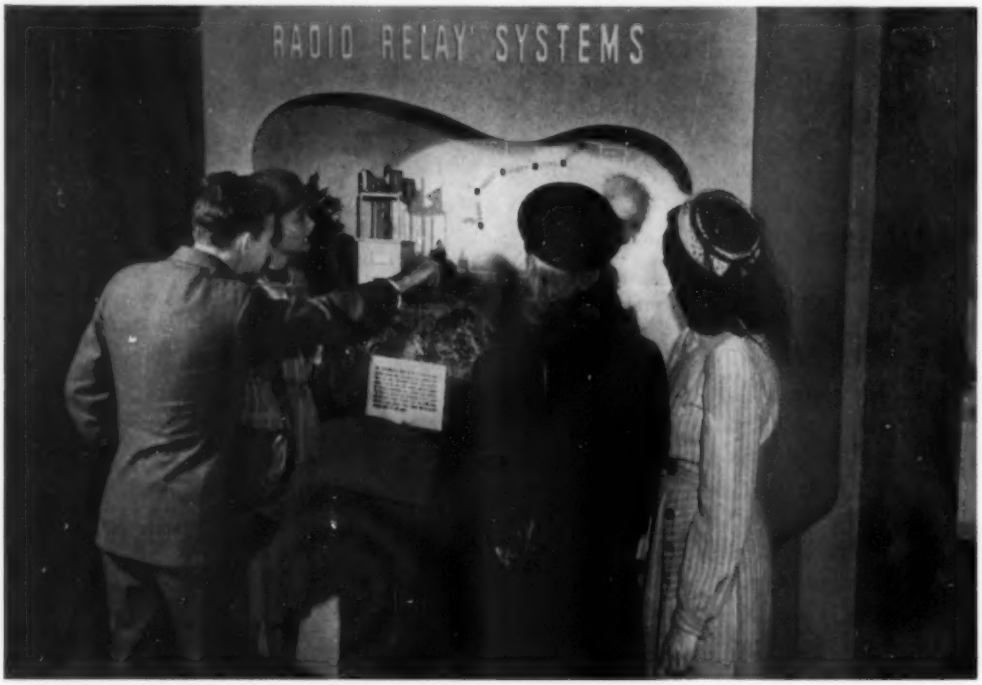
Our own risks in the comprehensive program to obtain split-second projection of television signals from one part of the country to another are not inconsequential. There are hazards of technical quality; there are hazards of production; hazards concerning frequency assignments; there are the usual hazards of intense competition in a new art which may be changed suddenly and violently over night by some unexpected invention or development; and, of course, there are the hazards of the loss of large sums of money.

Fruit of Free Men's Dreams

AND WHAT FAITH prompts the challenging and the risking of these hazards? That faith is simple. Its roots are deep in the belief that the American people will be as eager to have education, information, and entertainment brought to their homes to see as they were keen to hear; that in this modern day of instant communication, the extension of the ability to see distant places and people will add as much as or more than the extension of the ability to hear.

Nowhere but in America could a

A cutaway section of a coaxial cable splice, and a repeater and a gas pressure gauge, were included in the Bell System's exhibit of television equipment



This diorama of the Bell System's experimental radio relay system now being installed between New York and Boston was displayed at the television conference

project of this magnitude be undertaken with the zest and zeal and push essential to its early and successful completion. Just as our form of government has permitted free men to span this continent by rail and by air, to perfect a communications system which permits connection with the wide world, so too America encourages free men to risk their capital and their reputations in projecting sight to distant places. A great building, a bridge, a tremendous dam are magnificant works; but they are built best and lift the spirit highest when they represent the fruit of free men's dreams and of their vision and courage in making these dreams come true. We are proud and grateful that we have this heritage, and that our countrymen have the good sense to fight to preserve this right of free men to take a chance.

III. *Oliver E. Buckley*

IT IS NATURAL that the Bell System should have an interest in television for, like telephony, it is a system of transmitting intelligence electrically. The fundamental problems of transmission for telephony and television

are the same, and the same medium of transmission which works for one will work for the other. In each case, one converts intelligence into variations of strength of an electric current, transmits those variations over an electric circuit, and then reconverts them.

But there is a significant difference in television and telephone signals, in that the rate of variation differs widely in the two cases: for telephony, thousands of variations per second; and for television, millions. This is basically the result of the fact that we can absorb intelligence with our eyes much more rapidly than with our ears. In a given length of time, we can learn far more from looking at a picture with our eyes than we can get through our ears from hearing a description of it. Indeed, the signals of television must vary roughly a thousand times as fast as those of telephony; or, to put it another way, television takes a frequency band a thousand times as wide as that required for telephony.

Except for this, the problems of transmitting telephony and television are nearly enough the same so that the facilities for transmitting telephone conversations can be adapted to transmitting television.

Three Transmission Paths

THE THREE WAYS in which we transmit telephony, and how they are applied to television, are: first, by wire; second, by pipes or tubes; and, third, through open space by radio.

Any pair of wires which carries a telephone conversation can carry television, but because of the high frequencies involved it won't carry so far before the signals fade out to such a low level that it is necessary to boost them by an amplifier, or in telephone parlance a repeater. So we can use for television the very wires which are buried under city streets for telephone service, if we just apply to them enough amplifiers along the television route. It takes actually about one amplifier every mile. This method works well in practice but has a limitation in that we can use for television only a few of the hundreds of pairs of wires in a particular cable. If we try to use more, we get crosstalk between the different wires in the same cable. However, there are a lot of cables, and many television programs can be thus accommodated in existing cables.

A slight modification of the ordinary telephone cable, by including in it wires spaced a bit farther apart and shielded by a wrapping of metal foil, will let us transmit any desired number of television channels in telephone cables, and in this case the amplifiers may be placed farther apart. We are going ahead with the development of cables thus adapted for television, and they promise to play an important part in local television distribution of the future.

THOSE same methods of transmission of television over wires could be developed for long distance transmission as well as for local, but we have found it more economical in long distance telephone transmission to send the signals through a pipe or tube with a wire down the middle. Such a tube is called a coaxial conductor, and a cable embodying such

tubes is called a coaxial cable. Over a coaxial cable, we send hundreds of telephone conversations at once. Alternatively, we can transmit television. But because of the high frequencies involved in television, one television program demands the facilities which would accommodate hundreds of telephone channels.

As presently equipped for telephony, the coaxial cable handles television quite successfully and with little loss of detail. We recognize, however, that it does not go high enough in frequency at present to give the detail that will be demanded for television of the future. To meet that situation, we are hard at work pushing up the limit of frequency of the coaxial system.

Now a nice thing about the coaxial cable is that you don't have to change the cable to raise the limit of frequency, but only to replace the amplifiers by new ones more closely spaced and capable of working at higher frequency. We now transmit up to about 3 megacycles and expect with new amplifiers to advance that limit to 7 megacycles or more. But there is no basic reason for stopping there if ultimate demands go higher.

At present, we are not planning to send more than one program through a single coaxial tube. Hence the number of programs we can transmit over a given route will depend on the availability of tubes in coaxial cables. The most we now have in any cable is eight, and some of these must be held for telephony. But if we are willing to look far into the future, there is no reason for assuming such a limit. Methods will eventually be developed for hollow pipe or wave guide transmission which can handle groups of television programs as we now handle groups of telephone channels. There is no technical limit to what may be done with conducting structures. It is only a matter of economics and the demand for service.

THE THIRD MEANS of transmitting television is through open space by radio. Again, the means which we are developing for telephony will meet the needs of television. Here, as with the coaxial cable, it is economical to carry in one bundle large groups of telephone conversations. Alternatively, or additionally, we can carry television. A system for doing this is already in operation over the 20-mile span between our laboratories at 463 West Street, New York, and Murray Hill, N. J. The equipment in this installation has been engineered with the objective of ultimately meeting the severe reliability requirements of telephony, and it is a pattern for the equipment soon to be installed on the repeatered radio route from New York to Boston. This system may be looked on as an alternative to coaxial cable.

Now, it is a good question to ask what sets the limit to accomplishment in this problem of transmitting television signals. There are many factors which I will not go into, but one which is outstanding. As you all know, the arts of television and long distance telephony have developed around electronic tubes, and their advance has been coupled with the advance of electronics. As means have been devised to make vacuum tubes operate at higher and higher frequencies, the way has opened for broadband telephone transmission and for

the transmission of television. One limit after another has been overcome.

I can illustrate by the transmitting tube presently in use in the West Street-Murray Hill beam radio circuit. It is one of the Klystron type which was designed by Dr. Samuel of Bell Telephone Laboratories just prior to the war, and made use of principles discovered by the Varian brothers of Stanford University. The Klystron provided a way to overcome the limit set by the time it takes electrons to travel the small distances between the electrodes in the amplifying tube. It does this by making use of variation of velocity of electrons. This is sometimes referred to as bunching, for the distribution of electrons is varied along the electron stream in contrast to the older method of varying the number of electrons which could pass a grid.

The availability of this type of tube has let us go to 6,000 megacycles or more, which means waves less than 5 cm in length. These short waves can be focused into sharp beams, and this permits using low power to transmit from one station to the next. But this tube, too, has its limits. One cannot amplify very much with a single tube of this type. Also, the band width, and so the amount of intelligence or detail of picture, is limited, especially when you come to long distance transmission with many repeater points.

Dr. John Pierce with the traveling-wave tube he developed at Bell Laboratories

Recently this limit has again been broken, with a new tube working on quite new principles which I want to tell you about. It is a tube which was developed by Dr. John Pierce of Bell Telephone Laboratories and is called a traveling-wave tube. It works by having a stream of electrons operate on an electric wave much as wind operates on the surface of a pond to build up waves on water. Here in a bulb at one end of it is an electron

gun which shoots a beam of electrons down a tube which is like a gun-barrel, to a target at the other end. Inside the gun-barrel is a wire wound in the form of a helix or spiral and running the length of the gun-barrel, but not connected to the gun or the target. This spiral wire carries the electric wave to be amplified, the wave being fed in at the end close to the gun and out at the end close to the target.

In traveling the length of the spiral, the wave follows the turns of the spiral wire so it takes about 13 times as long to go the length of the gun-barrel as it would to go the same distance in a straight line. Thus the wave is slowed up enough so that the beam of electrons going down the middle can be driven faster than the wave. This is the condition for the electron to push the wave or feed energy into it. Thus an electron wind blows the wave up and it comes out at one end much stronger than when it went in at the other.

With a tube of this sort, we can amplify much more. The limit on band width is greatly extended. We can now think of transmitting numbers of television programs and bundles of telephone conversations at once through the same system and over any distance that we can span by an array of line-of-sight radio repeaters. The same principles in tube design can also be applied with advantage to coaxial and wave guide systems.

It should be pointed out that this tube has not been perfected. It is, on the contrary, an early development model, and has yet far to go before it becomes the practical and reliable instrumentality which can form a part of a commercial transmission system. But it does serve to illustrate my point, which is that there is no limit to what can be done in the electrical transmission of intelligence. The only limit is in the intelligence to be transmitted.

BEING somewhat familiar with the Bell System's relations with the public, we can only say that we know of no other private (or public) organization more determinedly solicitous of its clients' welfare, except for a touch of paternal sternness about talking too long during wars and an unrelenting impression of conducting its whole vast, complex operation solely for you. Subjected to its bright, old world charm long enough, any susceptible person could begin to get the idea that when he picks up the receiver, a hush comes over the Bell domain, thousands of technicians spring to their posts, trumpets blow somewhere in the distance, massive gears begin to grind, and a million ergs of electrical energy are spent just so you can say —"Hello, dear. Will you bring a loaf of bread on the way home?"

From an editorial in the *Main Line Times,* Ardmore, Pa.

The Bell System's War Record and Its Accomplishments of the Past Twelve Months Inspire Confident Expectation of the Rapid Restoration of Service Standards

"Service to the Nation in Peace and War"

William H. Harrison

Editors' note: The following paragraphs give the substance of Vice President Harrison's address to the 21st General Assembly of the Telephone Pioneers of America in Cleveland on September 18.

THINGS HAPPEN so fast and change so rapidly, it is hard to realize we are starting our second post-war year, and before touching on current matters I want to make brief reference to the Bell System at war.

There stands in the lobby of the A. T. & T. headquarters building in New York an impressive and beautiful memorial dedicated to SERVICE TO THE NATION IN PEACE AND WAR. The Operating Companies, A. T. & T., the Western Electric Company, the Bell Telephone Laboratories, individually and collectively gave substance and life to that dedication during the trying four war years.

The pattern of war devotion of the Bell System was the pattern of our nation as a whole. I had the good fortune to observe a fair cross-section of activities on the home front here, in Canada and in England, and on the combat fronts; and while in no way detracting from the valor and sacrifice of those doing combat duty —for their contribution to the cause of victory outdistanced all others—it is a privilege to pay tribute to the men and women in every walk of life and at every cross-roads of America who gave so much to make victory possible. Never before in the history of our nation or any other nation have a people so successfully and so unselfishly devoted themselves to the cause of war. I saw unbelievable and indescribable sights: fine examples of energy, devotion, enthusiasm, ingenuity, in factories and shipyards and communication and transportation work, in the Red Cross, the U.S.O., the Selective Service Boards. In common parlance, the butcher,

the baker, the candlestick maker gave long hours—late and all-through-the-night hours—many with anguished hearts for their loved ones in exposed areas.

Out of it all, never shall I cease to marvel at the spirit of America, and the spirit of our Allies of the British Empire and Soviet States of Russia—for I saw something of what the peoples of those countries gave to the cause of their victory and our victory.

HAND IN HAND with this pride in what our country did is pride in what you of the Bell System did. I wish time permitted telling of some of the spectacular accomplishments of the Operating Companies, and more particularly of the products of that great development-engineering-manufacturing team, Western Electric and the Bell Laboratories. On ship, in the air, on the ground in tanks and combat vehicles, behind the lines and in the forefront of the attack, their detection radar, gun firing radar, radio, wire communication, navigation aids, ammunition devices—all formed the backbone of the Army and Navy electronics equipment. Simply by way of illustration:—over half the radar used was the product of this great Bell System team.

High-lighting the job, at battle stations on every combat front, 68,000 Bell System men and women in the uniform of their country gave striking testimony that Bell employees know and accept the responsibility of citizenship. I saw them in far-off lands under strange and trying conditions, and I know of the character they made for themselves and for the Bell organization. In strange lands, comradeship of locality exerts a strong bond: Texans find comfort in other Texans, Californians or Brooklynites in fellow Californians and Brooklynites; but the bond of Bell comradeship is far more binding.

There is great satisfaction that V–J Day found us ending a determined and glorious period of service. Truly the war years were the System's finest, unequalled for sheer brilliance of performance and devotion to service.

As we swung into the road of service to the nation in peace, we were faced with all the pent-up problems of the war years.

Some 2,130,000 applicants were waiting for service. Our force was 60,000 hands short. Our plant was overloaded in a measure beyond the engineers' reckoning. Our manufacturer scarcely had ceased full time war production.

THERE WAS apparent reason to count on a pause in telephone demand. Instead, new applications mounted to heights beyond any previous experience, beyond predictions—almost, it might be said, beyond comprehension.

For the 12 months to date, there has been a net new demand for 3,400,000 main telephones—more than three times the highest pre-war year. Along with this, calling rates increased; material shortages became acute; the supply situation became worse, then better and now worse; war and wartime devotion and tolerances faded.

Burdened with what seemed an impossible task, 12 months of peace-time operations have produced achievement beyond expectation: the rapid reconversion of Western Elec-

tric, a truly remarkable job; building up of the System forces by some 160,000 people; renewed determination on the part of the men and women to serve.

To illustrate better the magnitude of recruiting and training: 12 months ago the operating forces totaled 350,000. During this period 315,000 people have been added—a tremendous and expertly handled job.

For the 12 months, total station gain has been 2,900,000 stations. Some 80 percent of the applications held a year ago are now cared for. There has been a 20 percent increase in volume of calls—with little additional plant but with greater stability of service and with no loss of public good will and confidence. These, I submit, are achievements of distinction—worthy of most cherished Bell System tradition.

You know far better than I that the going has not been easy—nor is it likely to be easy for some time to come. As fast as the older held applications have been cleared, they have been replaced by new ones in even greater number. And physical relief—although Western production and shipments already are well above the best pre-war levels and will be coming through in increasing volume in the months ahead—up to now has not been enough to make any considerable dent in existing shortages. In spots, facilities are not equal to the present volume of calls; and in these spots service labors and for want of facilities will continue to labor, and we will be unable for months to come to give the public the kind of service we know they should be receiving.

Yet in considered perspective, more people are getting more service, lower cost service, and better service than ever before. And from here on in, with but a reasonable break from outside suppliers and influences, and recognition by regulatory bodies of increasing costs and need for large sums of new money for expansion, measurable progress will continue.

THOUGH THERE ARE hazards ahead, confidence born of proven competence runs through the entire fabric of the Bell System organization. It is this proven competence which soon will again adequately serve the nation in peace.

Pioneers can take satisfaction and modest pride in the knowledge their experience, their ideals, their deeds give force to this expression of confidence. And I want to close on the note of pride I know each of us has in being part of the Bell System—that great institution dedicated to the Service of the Nation.

Farewell to WEAF

Keith S. McHugh

When the call letters of radio station WEAF were changed to WNBC, on November 2, Mr. McHugh, who is A. T. & T. Vice President in charge of Public Relations, was invited to take part in the program of observance. His remarks follow:

I SUPPOSE that relatively few of our listeners are aware that the American Telephone and Telegraph Company founded radio station WEAF in 1922 and managed it for the first four years of its existence. This was a pioneering venture in at least two important respects.

First, we were deeply interested in exploring every development that would make for better communication service, and WEAF was an extremely valuable proving ground, so to speak, for our study of radio techniques.

Second, and even more important, this station, in the days of telephone company management, pioneered the American method of supporting the expense of broadcasting service by selling time on the air to advertisers.

Although it is now 20 years since our company brought its own experiments in broadcasting to an end, our service *to* broadcasting has steadily grown and will, I expect, continue to do so. Every day, as Ben Grauer here speaks to WEAF listeners, he is actually talking over a telephone line. Your voice, Mr. Grauer, goes over the line from the studio to the radio transmitter and then is broadcast to all of your listeners. And not only do our telephone lines connect studios and transmitters—135,000 miles of them also link stations with other stations to make radio networks possible.

Thus it is that radio listeners in New York or San Diego can enjoy a football game in Chicago, just as if it were being played in their own neighborhood. And for the future, we are now building new types of facilities which will make it possible to send television programs over nationwide networks.

All of this is a far cry from the rather humble beginnings of WEAF in 1922. In August of that year we gave our first evening program, in an improvised studio in the long distance telephone building at 24 Walker Street, New York. The program included vocal and instrumental solos by amateur musicians among our local telephone people. There was also a baseball talk by Frank Graham, a recitation of a poem by James Whitcomb Riley, and music from records and a player piano.

Naturally, we of A. T. & T. can't help feeling a bit proud that *our* station has played such a significant part in broadcasting history and achievement. Tonight we join in saying "hail and farewell"—farewell to call letters which we instituted and which have been so long familiar to radio listeners—and a friendly hail to WNBC and to the new opportunities for radio broadcasting in the years ahead.

Nitrogen Gas Introduced under Pressure Protects Service Both by Transmitting Signals When a Leak Occurs and by Excluding Moisture until Repairs Can Be Made

Damaged Telephone Cables Send Their Own Alarms

Leon W. Germain

SPRING FLOODS had disrupted service on two aerial long distance telephone cables crossing Pennsylvania by way of Shippensburg and Bedford. The two remaining cables, routed through Altoona and Lewistown, were taking a severe beating from the water and were already showing signs of trouble. It was not long after the first two cables had failed that alarm signals at Lewistown and Altoona indicated damage to one of the two remaining cables, and early the next morning another signal in the Altoona testroom heralded further trouble.

Promptly after the first alarm, repair men were dispatched from both Lewistown and Altoona; but with the roads flooded, both crews were soon stopped. It looked like the final stage of a complete service interruption on one of the most important Long Lines toll routes.

Shortly after the second alarm came in, the Altoona testroom received a telephone call from a farmer near the scene of the trouble. He reported that the pole line near his farm had washed out, dropping the cables into the water. In fact, he had been out in a boat (most providentially available) and noticed bubbles coming up from one of the cables. He went on to say that he had often watched the section man putting gas into the cables, and as there were valves above water on each cable, he would be glad to attempt the job of gassing them if gas could be made available to him.

(The farmer alluded to the standard practice of keeping long distance telephone cables filled with nitrogen

Testing the gas pressure in a reel of cable before it is loaded onto a cable-laying train to be plowed into the ground. Low pressure would indicate a leak in the cable sheath

gas under pressure, so that if the cable sheath is punctured, the gas pressure prevents the entrance of moisture.)

This obliging and enterprising individual went on to say that there was a dry meadow on his farm where a small airplane might land with the necessary equipment.

Just about that time, two pairs in one of the cables failed—due, obviously, to moisture. It was plain that, with the loss of gas pressure, it would not be long before the cables were waterlogged.

Flying weather was not good, but the Altoona airport was dry, and a pilot offered to try to reach the farm in a small cabin plane. He figured he could carry one man and a cylinder of gas, or two cylinders of gas. After considerable discussion, it was decided that the second cylinder was more important, and from what the farmer had said, it would not be too much. So the chief testboard man wrote out some instructions which he gave to the pilot, with a prayer that he and the farmer could work it out between them. Then he went back to the testroom, to be met with the news that two more pairs had failed.

In the meantime, the farmer had marked off a landing strip. He signalled the pilot and the latter tried for a landing. On the second attempt he made it, and he and the farmer hauled the gas cylinders over to the cables and connected them to the valves.

Altogether, only eight pairs failed out of about 600 in those two cables. When the water receded a few days later, the sheaths of both cables were found to be punctured in several places.

THE IDEA of keeping nitrogen gas under pressure in toll cables as a means of constant protection against moisture developed about 20 years ago out of the use of vapors of vari-

"Flash testing." The sleeve covering the splice in this buried cable is being painted with soapsuds, which will bubble if gas can escape through leaks in the solder

ous kinds to test the tightness of cable sheaths. The results were so gratifying that all toll cables maintained by Long Lines are now kept permanently under gas pressure. Associated Companies have likewise adopted this protective device, and the greater part of their toll cables are kept filled with gas.

Gas has done a remarkable job in reducing cable failures and maintaining the continuity of toll service. This was particularly important during the War, when every available facility was urgently required for the war effort. It is no less important now, when all toll facilities are so loaded that if serious troubles or failures should occur on any of the toll cables, there are almost no spare facilities available over which the services may be re-routed.

It is significant that in 1929, when the program for gassing cables was getting under way, there were 247 pair troubles a month per 1000 sheath miles of ungassed underground cable; while in 1945, with all underground cables under permanent gas pressure, this figure had dropped to 12 pair troubles a month per 1000 sheath miles. Similar figures for aerial cables show 91 pair troubles a month per 1000 sheath miles in 1929 against 29 in 1945.

It will be noted, in the figures given above, that the use of gas had a greater effect in improving the performance of underground cables than was the case with aerial cables. One reason for this is that underground or buried cables frequently lie in moist ground or even under a head of water so that any small crack or hole developing in the sheath may, without the protection of gas pressure, immediately wet the entire cable. Another reason is that underground or buried cable, protected by Mother Earth, is not exposed to certain haz-

ards resulting in damage to wires in aerial cables which gas pressure cannot prevent. Among these are fires near the aerial cable line, and bullets fired by unskilled or careless hunters.

Toll cables are charged with dry nitrogen gas at a pressure of seven pounds per square inch in aerial and ten pounds per square inch in underground and buried cables, figured at a temperature of 60° F. These pressures will, of course, be greater at higher temperatures and less at lower temperatures. The higher pressure used in underground and buried cables is to afford greater protection against moisture when a cable is submerged under water. For every two feet of water over the cable, one pound of pressure will successfully resist the entrance of moisture.

Gas-tight Cable Sections

CABLE under pressure is divided into gas-tight sections 10 miles or more in length. Every two or three miles an alarm "contactor" is installed. A contactor may be compared to a steam gauge, the needle of which will close a contact when the pressure in the cable is reduced to a predetermined value and thereby signal a nearby testroom. At about half-mile intervals along each cable, valves similar to ordinary tire valves are soldered into the cable. These permit the cablemen to determine the pressure at each of these points with considerable accuracy—and, if desired, to add gas at those points.

Let us assume now that a section of aerial cable is filled with gas up to pressure. A rifle bullet intended for a deer drills the cable. It is a soggy Fall day of wind and intermittent rain. If it were not for the gas escaping through the holes made by the bullet, water would soon begin to soak the paper insulation of the 600 wires inside that cable. But the gas pressure keeps the water out.

At the same time, the escaping gas naturally causes pressure in the immediate vicinity of the hole to fall; and when it has dropped three or four pounds at an adjacent contactor, a contact closes. The contactor, through a pair of wires in the cable itself, rings a bell in the testroom 30 miles up the pike. Although some gas has already been lost, it leaks slowly through even a relatively large hole, and the remaining reservoir of gas in the cable will keep out the moisture for a number of hours after a contactor has operated.

Since all of the contactors in a considerable stretch of cable are connected to a single pair of wires, there is no indication as to which particular contactor gave the alarm. However, by the use of a Wheatstone bridge, the man at the testboard can measure the resistance of the circuit completed by the contactor, which will immediately tell him which contactor it is.

Repair men are sent out to the vicinity of the contactor which operated. As these are at two- or three-mile intervals, the men might have quite a time locating a small bullet hole on an aerial cable, especially if it was dark by the time they got there. They have the tire valves, however, to help in the search. They note the pressures at valves on either side of the contactor and find that these pressures drop off and rise again. Obviously the break must be between the two valves with the lowest readings.

This is still not close enough, since the valves are half a mile apart. However, if the searchers plot on cross-section paper the pressures shown by a number of valves on either side of the low-pressure point, and then draw lines through them, thereby establishing the "pressure gradients," they will pin the location of the sheath break down with satisfactory accuracy. This operation is illustrated on page 168.

Sometimes the physical damage suffered by a cable results in "crosses" or "grounds" on some of the wires. In such a case the testroom man can make resistance measurements and locate the break without waiting for the repair gang to determine pressure gradients, for the Wheatstone bridge will put its finger down very close to the actual trouble.

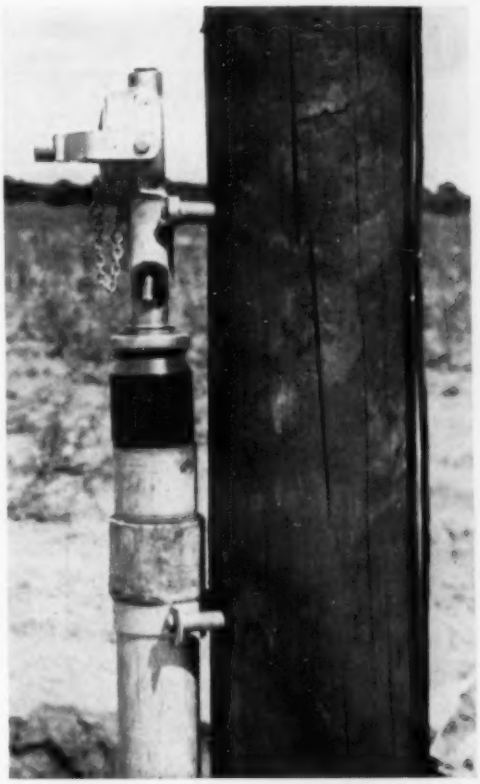
Where Gas Would Have Helped

IN THE EARLY DAYS, when gas in cables was unheard of, the only prevention against porous solder work and punctured sheath was to make a time-consuming and laborious visual inspection—which might or might not detect a defect. As long as joints were properly sealed and the sheath was unbroken, the cable would give no trouble; but when they were not, there was plenty of work for the outside maintenance and testroom people. Almost any not-so-old-timer could tell stories of drowned cables. For instance—

Some years ago, a group of cable splicers had just finished cutting over open wires into a brand-new toll entrance cable. It was a raw day with high wind, and by late afternoon a blizzard had set in. The men who had been working on the poles were still thawing out frozen fingers when the report came from the testroom that one of the circuits which had been cut over had failed. While they were looking for trouble at the terminals, another circuit went out, and from then on it was a succession of trouble reports.

Measurements located the trouble near a river crossing. There was nothing for the splicers to do but spend most of the night back-tracking on their job, cutting the wires back to the old open-wire line.

The next day they dug down to the cable beside the river crossing.

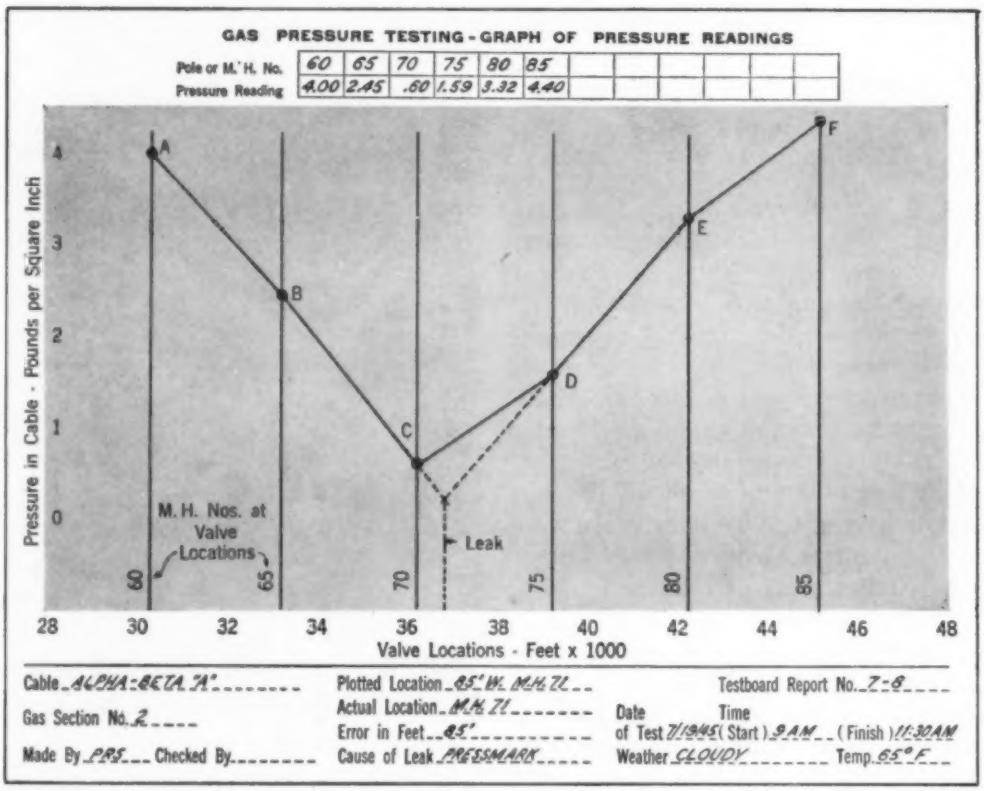


The pipe at the left of the pole, rising from a gas-filled buried cable, permits testing of both the gas pressure and the contactor alarm at this point, and also enables the cableman to talk with the test board

There was a hole in it, covered with a clumsy wooden clamp. Investigation showed that some workman, digging a ditch, had struck the cable with his pick a number of days before, and instead of reporting it, he had covered the hole with the clamp. The storm on the day of the cutover had raised the water level until it reached the cable. Gas pressure would have kept the water out of the cable and given warning of the break, so that it could have been repaired before the cutover was made.

On another occasion a cable in a duct underneath a bridge failed when a flood submerged the duct. When the water receded, a large hole was found in the cable sheath, evidently caused by lightning. As the duct was normally dry, it is not improbable that the cable had lain in this condition for months.

These are typical examples of what used to happen before the days of gas pressure. Holes and cracks would develop in cable sheaths, but in the dry season no one would have warning of them. When the rains descended and the floods came, every testroom in the storm area would be in an uproar. In contrast to this, gas pressure tips off neighboring testrooms soon after a break of any kind



A pressure graph, showing how readings at valves on either side of a low-pressure point may be charted to locate the point of cable sheath damage

occurs in a sheath, permitting repairs, before service is affected.

Developing Gas Methods

AN EARLY USE of gas for the purpose of testing the tightness of solder work in a telephone cable was initiated about 1912 by the Bell Telephone Company of Pennsylvania. In this use, plant forces gave a cable what was called the "flash" test: dry air was forced into a section of the cable and they listened for gas leaks and checked gauge readings at either end of the cable for 10 or 12 hours.

Dry air was also recognized as a means of dessicating a wet cable. When the air was forced through such a cable, it dried the paper insulation—just as one of those hot air devices in a washroom dries the hands.

The great difficulty experienced in the use of air was to free it from moisture. Moreover, the air-conditioning apparatus usually consisted of a compressor and a number of large storage cylinders containing trays of calcium chloride, put there to absorb the moisture. This apparatus was cumbersome, and required care to produce air sufficiently moisture-free.

Soon after World War I, the French introduced the process of testing cables with an absorbent gas, carbon dioxide. This was much more effective and economical than the chemically dried air.

Although the carbon dioxide apparatus was superior to the air-drying equipment, it had numerous disadvantages. Unless the tanks were kept at a reasonably high temperature, carbonic snow formed at the outlet, which did not improve the flow of the gas. Also, water formed in the bottom of the tank, which had to be drained off.

In 1925, the A. T. and T. Company's Department of Development and Research (now incorporated with Bell Telephone Laboratories) issued the results of tests with oil-pumped nitrogen, which indicated that it was superior to either carbon dioxide or dried air. While the supply of this was limited, sufficient quantities became available and it has since been universally used in the Bell System. It has none of the disadvantages noted above for carbon dioxide. It is obtained from the manufacturer in cylinders under a pressure of about 2000 pounds per square inch, and regulators are used to reduce the pressure at the outlet to the desired value.

IN JULY 1925, Long Lines made its first extensive use of nitrogen gas for testing, on the aerial line being built between South Bend and Toledo. While the main thing this test proved was that the soldering job on this cable was 100 percent in the sections tested, it suggested the idea of making similar tests on an underground cable. At that time the "C" cable was being placed between Boston and Providence. The splices on this underground cable were "flash tested" with gas pressure and 38 small leaks were found in the 760 splices tested.

Shortly after this, in the Spring of 1927, gas pressure was introduced into the old Philadelphia-Reading "A" cable for a distance of 30 miles, as a permanent protection from excessive moisture trouble occasioned by ring cuts and cracks in the sheath. It was on this cable that the first gas pressure plugs were introduced.

These plugs, shop manufactured sections of impregnated cable about 10 ft. long, spliced into the main cable, prevented the gas from flowing out of the terminals and into the many branch cables. The first arrangement had valves at intervals of 2½ miles, with the gas under 15 to 20 pounds' pressure.

AFTER the cable was charged, daily pressure gauge readings at the valve points indicated low pressure in two sections, each about three miles long. With the object of locating the cause of leakage in these two sections, a gas flow indicator was developed. This consisted of a U-shaped glass tube filled with oil. Since the gas pressure decreases as the leak is approached, by connecting the indicator between two valves a few feet apart, the column of oil would be depressed on the high-pressure side and rise on the low-pressure side—which would be in the direction toward the leak.

This worked all right for large leaks; but when the location of small leaks was attempted, it was soon realized that the old familiar Charles's Law operated inside telephone cables as well as anywhere else, and consequently gas expands in a section of higher temperature and flows to one where it is lower. This introduced considerable difficulties in the search, since it upset the small differences in pressure on each side of the leak.

One ingenious proposal for the solution of this difficulty was the use of scented gas to locate trouble. Gas scented with peppermint was tried, but it was found that the paper insulation around the wires in the cable absorbed the peppermint flavor, and the escaping gas was odorless. Other odors were equally ineffective, and the problem in this particular case was finally solved by isolating the low sections through the installation of temporary gas plugs. This led to the introduction of permanent gas-tight plugs at 10-mile intervals to reduce the length of the section under test. These plugs were made in the field by cutting away a section of the sheath, covering it with a lead sleeve and filling the sleeve with a hot wax or asphalt compound.

Gas Pressure Is Standardized

DURING the next few years, interest in the possibilities of gas pressure to reduce cable failures was at a high level in the Long Lines Department. Late in 1927, instructions were issued to the field to pressure-test all cables being installed, in order to locate construction defects. About this time, it was also decided to place all Long Lines underground toll cables under permanent pressure, and in 1929 a similar treatment was decided upon for aerial toll cables. All the experience with methods and materials which had been gained during the trials was then issued in instruction form.

In the Summer of 1931 an exhaustive series of tests was made by the Bell Laboratories on a 25-mile section of underground cable between Morristown and Chester, N. J. As a result of these tests, it was concluded that the pressure in underground cable should be reduced to nine pounds and contactors set to operate at six pounds, and in aerial cable the pressure should be six pounds with contactors set to operate at three pounds. The contactor

spacing was set at two miles, the valves (for recharging and pressure testing) were spaced at 3,000-foot intervals, and the length of a gas section was set at 10 miles.

THE MORRISTOWN tests resulted in numerous other important contributions to gas pressure practices. Engineers developed a formula for charging cables with gas and introduced a new type of gas flow indicator and mercury manometer for locating small leaks.

The gas flow indicator is a hollow glass valve so arranged that when gas in the cable is by-passed through it from valves installed a few feet apart on the cable, the flow of gas will blow ammonia fumes over a small strip of chemically treated paper and cause it to turn pink. The direction of flow is determined by observing at which end of the valve the treated paper changes color.

The manometer consists of a long calibrated glass tube containing a column of mercury similar to that in a thermometer. When the manometer is connected to a valve and the gas pressure in the cable applied, the column rises. This allows a much more accurate reading of pressure than had been possible with the standard pressure gauges, and thus greatly increases the precision of leak location.

A similar test was undertaken a few months later on an aerial cable between New York and Southfields. Among other things, these tests showed that variations in temperature throughout an aerial cable were too small to seriously mislead cablemen in locating a large leak, but did cause difficulty in finding a small one. It was also found that there were certain periods when temperature changes were at a minimum, at which times it was much easier to find a small leak. The best times, the tests indicated, were on a cloudy day or in the interval between dawn and sunrise,—a discovery not hailed with delight by cable maintenance men.

Refining the Process

SOME IDEA of the exhaustive nature of the studies of the subject of vapor phenomena in cables is revealed by a glance at the instructions covering gas pressure work. For example, corrections must be applied for change in altitude of a cable climbing a mountain, as well as for variations in temperature and in the barometer. Allowance must also be made for the different resistances to the flow of gas in cables of various types and make-up. Gas sections longer than the original 10 mile length have been found practicable in the newer cables, and where two cables are on the same route they are connected together at the plugs to form so-called circular gas sections. This latter arrangement is a distinct advantage from a protection standpoint, since it does away with the danger that a leak occurring close to a plug will quickly drain the gas on the plug side and allow water to enter the cable.

In order to keep the maintenance and supervisory personnel posted and trained in the latest developments and methods, gas pressure training courses have been held throughout the Long Lines Plant Department. A novel feature of these courses is apparatus which visualizes the behavior of the gas pressure in a cable when leaks occur. This consists of

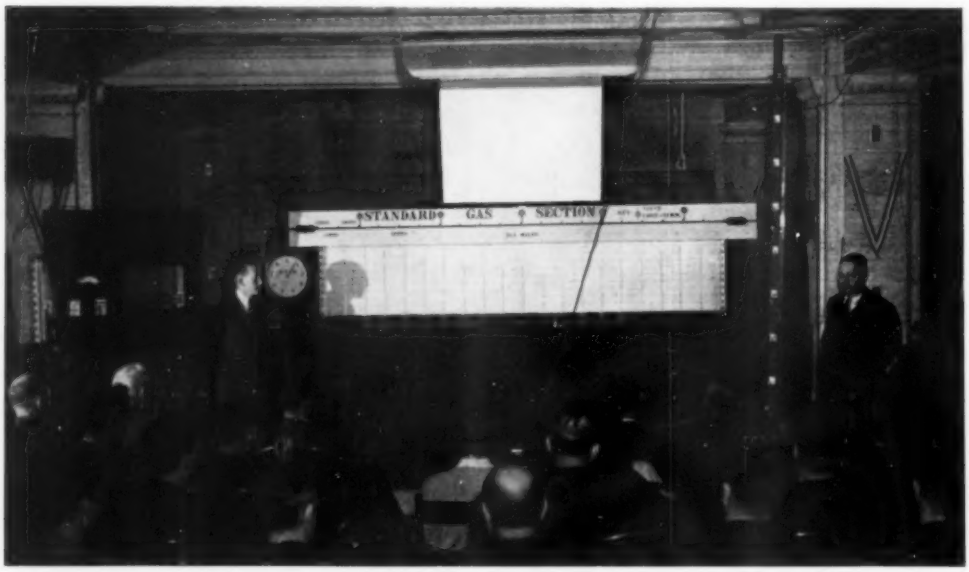
about 1000 feet of small-size cable simulating a normal gas pressure section, with 21 manometers connected at 50-foot intervals and mounted side by side. These manometers show the pressure along the cable and permit the men to see at a glance just what happens to the pressure under various conditions.

Long Lines Training Program

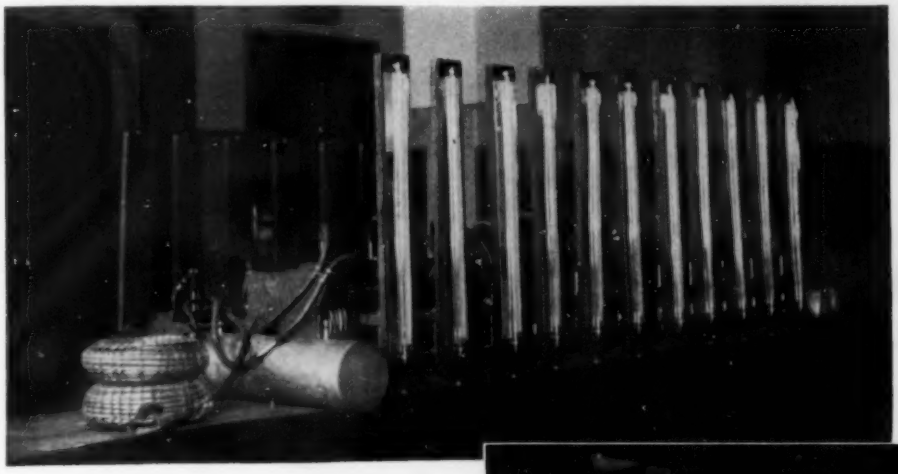
THIS training program has been divided into four different courses. A half-day appreciation course is given to Long Lines and Associated Company supervisory and management people who are broadly interested in the subject. The remaining three courses, each of two weeks' duration, are respectively: for those field people who are actively engaged in placing and maintaining cable under pressure; for those directly concerned with the supervision of gas pressure work; and for those engaged in engineering gas pressure systems.

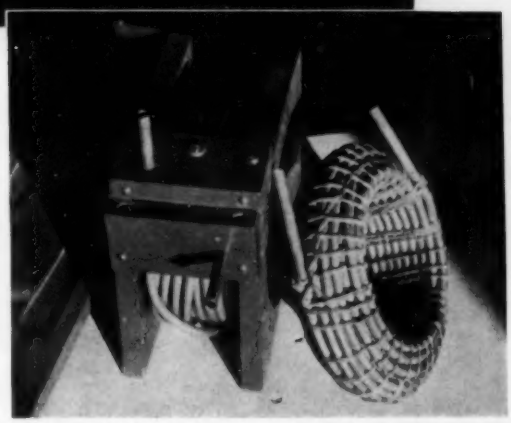
The apparatus illustrating behavior of gas pressure in a cable was made up into several portable exhibits which traveled all over the country. This apparatus and the four training courses have brought the facts about gas pressure to hundreds of Bell System employees—to those in the Long Lines who have had the job of keeping an eye on that Department's 18,000 miles of sheath, and to Associated Company people who are engaged in the installation and maintenance of toll cables.

The protection to service afforded by gas pressure is becoming increasingly important with the introduction, in the last few years, of K-Carrier systems in existing voice frequency cables, whereby twelve telephone circuits are superimposed on one pair of



A lecture-demonstration in the field, part of a training program to keep maintenance and supervisory personnel posted on methods and developments of gas pressure testing





Some of the demonstration apparatus used to show the behavior of gas in cable. Above: 1,000 feet of small cable, connected to manometers at 50-foot intervals, simulate a normal gas pressure section. Right: Such 50-foot sections of cable are interconnected to form the 1,000-foot section used in the demonstration

wires. Such protection is even more important for the Bell System's new coaxial cable network, which is now being installed throughout the country. Without it, the concentration of so many important circuits under one cable sheath would be hazardous.

As is usually the case in regard to telephone facilities, the most exhaustive sort of test cannot write the last chapter to gas pressure technique. For example, the introduction of a new type of cable—the buried cable—resulted in a need for more accurate leak locations. The various types of sheath protection with which these buried cables are covered may cause gas to flow under the covering for a considerable distance from the actual break in the sheath before it is released. However, refinements in methods and equipment for locating a sheath break have been developed, and specialists in gas pressure feel that whatever problems may be created by new designs of cable, they will be able to solve them.

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FOOTNOTES TO AMERICAN HISTORY

Alexander Graham Bell gets a wrong number during one of the early demonstrations of the telephone

Alexander Graham Bell gets a wrong number during one of the early demonstrations of the telephone

Thoroughgoing Preparations Permitted Changing All of a Great City's Telephone Numbers with a Maximum of Public Coöperation and a Minimum of Difficulty

Philadelphia Goes "2-5"

Harold S. LeDuc

FROM THE DAYS of vaudeville—and probably long before that—Philadelphia has been joked about, satirized, and maligned as a city where any change is regarded as painful, any deviation from "things as they have always been" carefully shunned. Philadelphians, the old saying goes, are "taller and fairer than Chinese, but not quite so progressive."

But recently a change was accepted by Philadelphians—with great good nature—that makes these allegations seem an undeserved and libelous label on a great and growing city.

Literally overnight a change took place in Philadelphia which called for the coöperation of all telephone users. It was a change which at first glance might seem trivial—but which actually was far-reaching in both its immediate and its ultimate effects on the city's telephone service.

Since Philadelphians first started using dial telephones, early in the 'twenties, they had been accustomed to dialing the first three letters of the central-office name, then the four digits that make up the telephone number. Last July 5th, they changed this long-established habit with one brave stroke and instead began to use only the first two letters of the central-office name, plus a newly added digit, and then the four digits of the telephone number.

A small change, it might seem—merely the substitution of a figure for a letter.

But dialing is such a familiar, every-day act that with most telephone users it's almost as natural and automatic as breathing. And, paradoxically perhaps, a small change in a deep-set habit is harder to make than a big one.

In any case, the change was made smoothly and painlessly. Philadelphians took it in their stride, and the new way of dialing is fast becoming second nature for them.

The shift from 3–4 to 2–5 dialing

"PREVIEW"
ANNOUNCEMENT
to all users of telephones
in the City of Philadelphia
Here's how
easy all this will be
A NEW
TELEPHONE NUMBER PLATE
FOR YOUR TELEPHONE
IS ENCLOSED
An Important Message
To Our Philadelphia Customers:
Starting July 8th, a figure will be added to the name of each Philadelphia
Central Office and that figure is to be used in dialing in place of the third
letter of the Central Office name.
For example -- PEnnypacker 2725 becomes
PEnnypacker 5-2725 and to reach it you dial
PE 5-2725 instead of PEN 2725
The only difference is that you dial a "5" instead of an "N".
1. Tear out the temporary card (it has the first 2 letters of the Central
Office name in large capitals) on top of the number plate on your
telephone. You can lift it out easily with a nail file or fingernail.

was made for a number of sound reasons.

First, it provided for a vast number of new central-office codes. Of course, when three letters are used in a dialing code, they must be the first three letters of the central-office name—and only a limited number of such combinations make good names which are easy to dial correctly and are easily understood when passed over a circuit or left in a message. Under the two-letters-and-a-figure system, Philadelphia can now have not only a "PEnnypacker 5" central-office, but also a "PEnnypacker 6," "7," "8" and so on. And that's important as a city's telephone system grows.

Second, direct dialing of Philadelphia numbers by telephone users in the city's widespread suburbs is just around the corner. As fast as we can get the dial equipment, suburban offices will be converted to dial and direct customer dialing to Philadelphia will begin. In fact, it is already in effect in one suburban office—Whitemarsh.

This, too, will call for a greatly increased range of unduplicated central-office codes. For instance, in Philadelphia we have a Chestnut Hill central office. In the suburbs, there are Cheltenham, Chester Heights, Chester Springs—all beginning, you

Newspaper advertisements, booklets, and letters mailed to subscribers were among the elements of the carefully timed and coördinated educational campaign which kept customers fully informed of the progress of the program and of their part in it

notice, with CHE. Under the new system, the code for Chestnut Hill is "CH–7"; other figures will be added to the "CH" of the various suburban offices.

Third, the new dialing system is a necessary step in the extension of intertoll dialing. Here again the problem is to avoid duplication of dialing codes over a very much wider area. The 2–5 system will provide the needed flexibility.

OF COURSE, 2–5 dialing is not a new story. It was introduced in New York back in 1930, and has been in use not only there but in northern New Jersey and other parts of the country. What made it an unusually interesting problem in Philadelphia was the timing.

The change to 2–5 was introduced to Philadelphia at a time when the city's central offices were carrying record-breaking volumes of traffic—often beyond the capacities of the offices—with the result that delays in dial tone had reached serious proportions.

Inevitably, the introduction of new dial codes would carry the danger of an increase in traffic volumes, since customers dialing old codes would have to dial the call again after learning the new code. Should the percentage of wrong codes dialed reach the proportions encountered in other communities in the past, it might seriously affect the service in the heavily loaded offices.

So the problem was simply this: to effect the change with negligible wrong dialing by the telephone-using public, thus reducing to the minimum the added burden of extra calls.

One obvious course to follow would have been to add sufficient switchboard positions, hire enough operators, and intercept all calls dialed incorrectly. Even in normal times this would have been difficult and costly; under present conditions, we simply could not get the equipment and we could not get the operators. Actually, a much better plan was devised, by installing the type of recording equipment used to give weather reports and using that to intercept calls dialed with the old codes.

So the success or failure of the change hinged almost entirely on getting the story over to Philadelphia's telephone-using public in such a way that they would understand the nature of the change and remember it when dialing. And, since this involved a change in ingrained habits, it could be accomplished only by what is known as "saturation" advertising.

Planning Started Far Ahead

THE TRANSITION PROGRAM started a year ahead of the cutover date, and with it started the advertising campaign.

The first step was to change the number plates on all Philadelphia telephones, and this involved explaining what it was all about. Before the change was made, Philadelphians began reading about it in newspaper advertisements, bill inserts, and news releases, and hearing about it on the radio. They were told why we were changing the number plates, and their alarm as to any effect the change might produce in their service was allayed.

The change of nearly half a million number plates—a tremendous job in itself—was done in part by high-school boys employed for the

Window displays announced the news in three dimensions

purpose during the summer of 1945, in part by our regular installation forces, and in part by mail. It is of interest that a telephone check of those mailed—some 70,000 — revealed that customers found very little difficulty putting the plates on their telephones.

Next came the job of completely re-setting the type for the Philadelphia telephone directory and giving proper instructions for its use. This large job was complicated by the fact that with this issue it became necessary to split the Philadelphia book into two volumes—Alphabetical and Classified—because of the tremendous increase in its size resulting from the increase in telephones during the last year.

The big task of delivering more than a million Philadelphia telephone directories began June 3rd of this year and was completed by July 1st. The educational and informative advertising, starting well in advance of the time of directory delivery, explained as its first phase the directory situation. Customers were told to keep their new directory under wraps and to continue to use their old directories until July 5th, then to start using the new book. The directories themselves carried a special imprint with this message.

Then came an intensive advertising campaign of the transition date and what telephone customers should do when that date rolled around. Seven o'clock in the morning, Friday, July 5th, had been selected as the time of cutover in order to take advantage of the long holiday week-end when normal traffic would be low.

"*Saturation*" *Advertising*

PHILADELPHIANS began hearing and reading about July 5th as early as February 7, 1946. They heard about it through radio announcements, newspaper advertisements, bill inserts, newspaper stories, car cards, truck posters, and such publicity media.

Publicity in connection with the change has been called "saturation" advertising—and "saturation" advertising it truly was.

One large advertisement per week appeared in Philadelphia's four daily papers from May 13th through June, and one advertisement per day in the morning papers of July 1st, 2nd, 3rd and 4th, and in all dailies for the three days following the cutover. In addition, three small advertisements a day were scattered through the papers the week of July 8th. Philadelphia's 34 "neighborhood" weeklies and 21 German, Italian, Polish, Hungarian, Jewish and Negro papers also carried advertisements.

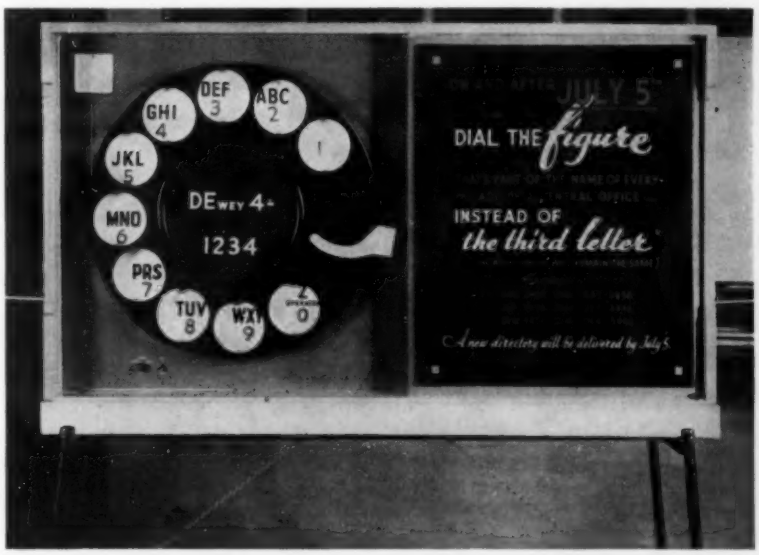
The nine radio stations in Philadelphia carried a total of 441 one-minute spots (7 hours and 21 minutes of air time) as well as 206 "station breaks" of 25 words each. The "breaks" were translated into Yiddish, Polish, and Italian for use on Philadelphia stations carrying foreign language programs.

Bill inserts going to Philadelphia customers told the story in the May, June, and July issues.

Even the blind—always great users of telephone service—were not forgotten. Through the Volunteer Service for the Blind, 3,500 code cards in Braille were sent to the city's sightless telephone users.

PERHAPS THE most important single piece of publicity in connection with the change was the letter mailed to all Philadelphia and Suburban Philadelphia customers just before the cutover. Letters were mailed to 355,000 Philadelphia customers—as far as we can ascertain, the largest single mailing ever made in the city—as well as to 125,000 customers in the Philadelphia suburbs.

One convincing bit of evidence that mail from the telephone company receives close attention from the public is the surprising number of returns



This exhibit was used during "open house" programs to demonstrate on a large dial the change from figure to letter for the third pull

Every opportunity was grasped to convey information to groups of persons who would be particularly affected by the number change

of the business reply card enclosed with the Philadelphia letter. This card, requesting a personal telephone directory for listing numbers with the new codes, was returned by 138,000 customers—about 39 percent of the total. PBX extension users accounted for 112,000 additional copies of the Personal Directory.

The Final Test

THAT THIS "saturation" campaign did a job was well evident when July 5th finally came.

At 7 A.M., July 5th, the announcement machine used for intercepting went to work. Customers who dialed the old three-letter codes which had been changed heard the recorded message, "Will you please dial the first two letters and five figures as shown in the new directory? Thank you."

But between 7 and 8 A.M. of the cutover day, only 22 percent of calls were dialed with the old codes, and by the busy hour the percentage had dropped to 12.

This good start in the early morning was most important. It made it possible to intercept all incorrectly dialed calls where the new code differed from the old up to 10 A.M. and practically all such calls between 10 A.M. and 12 Noon. After this time, it was possible to intercept all incorrectly dialed calls from Friday Noon until 10 A.M. Monday.

While only 5 per cent of the total calls in the city were incorrectly dialed, interception had to be discontinued in three offices between 10 A.M. and 12 Noon Monday because of the high volume of traffic. After noon on Monday, July 8th, it was possible to intercept *all* incorrectly dialed calls.

IF THE publicising of the change had been less effective and Philadelphians had been as slow to accept change as they are supposed to be—if, say, they had dialed the old codes on as much as 40 per cent of calls—only half of them could have been intercepted. This would have prolonged the transition period and might well have come close to putting some of the most heavily loaded offices out of service.

At first customers were inclined to "talk back" to the recorded voice when they were intercepted and to ask questions. Others attempted to dial again without first hanging up. So the recorded message was changed to, "Will you please hang up and dial the first two letters and five figures shown in the new directory? Thank you. This is a recorded message." This resulted in much less talking back to the machine and fewer attempts to dial without hanging up.

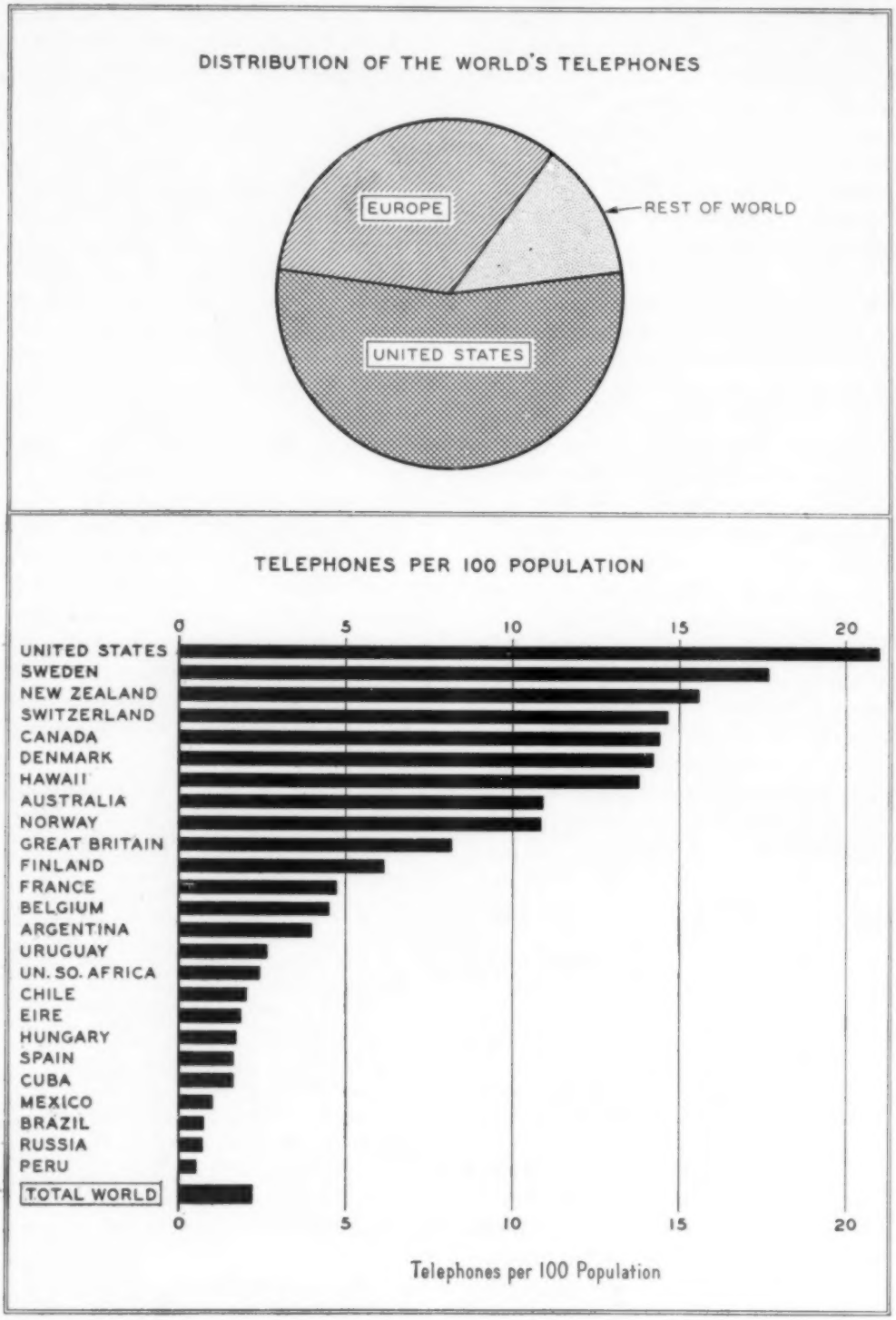
It wasn't long until "The Voice" of the intercepting machine had become something of a local celebrity. The girl who had made the recording was interviewed on a local radio program, and a Philadelphia columnist told of a lady who never dialed incorrectly except when she did so purposely just to hear the voice correcting her. The columnist's only suggestion, by the way, was that the recorded message should tack on something like, "Is that clear now, Toots? Toodle-oo," so that he could reply, "O.K., Babe."

By the end of the first week following the cutover, Philadelphians were dialing the old codes on only 3.2 percent of calls; after two weeks only 2.5 percent; by July 24th, 1.9 percent. As this is written, they are dialing the old codes on only 1.2 percent of calls—slightly more than one call in a hundred.

So the next time you hear someone say that Philadelphians won't accept change, you can say, "That's not the way I heard it!"

ALTHOUGH Williams' shop was dingy and ugly, and crude in all its arrangements, from my first day there I was happy and contented. And when I grew more skillful in using tools and was entrusted with the construction of complete machines, I often felt an exaltation in my work akin to the ecstacies of my lonely walks. In the woods I felt myself a living part of all creation; now I was thrilled with the knowledge that I myself was creating as I made stubborn metal do my will and take the shape necessary to enable it to do its allotted work. I should have been surprised then if anyone had called those moments poetic, but I know now there was some noble poetry in my life at Williams' shop.

From "Exploring Life," the autobiography of Thomas A. Watson; D. Appleton & Co., 1926


DISTRIBUTION OF THE WORLD'S TELEPHONES
EUROPE
REST OF WORLD
UNITED STATES
TELEPHONES PER 100 POPULATION
0
5
10
15
20
UNITED STATES
SWEDEN
NEW ZEALAND
SWITZERLAND
CANADA
DENMARK
HAWAII
AUSTRALIA
NORWAY
GREAT BRITAIN
FINLAND
FRANCE
BELGIUM
ARGENTINA
URUGUAY
UN. SO. AFRICA
CHILE
EIRE
HUNGARY
SPAIN
CUBA
MEXICO
BRAZIL
RUSSIA
PERU
TOTAL WORLD
0
5
10
15
20
Telephones per 100 Population

Telephones in the Post-War World

James R. McGowan

AT THE BEGINNING of the first peace-time year since 1941, the United States had approximately 28 million telephones, or 54 percent of the world's 51.5 million telephones. During the four war years, this country's telephones increased about 19 percent, despite shortages of materials and labor; while those of the rest of the world gained only four percent. If the telephone companies had been able to install all the telephones requested, there would have been another 10 percent increase in the United States during that period.

The latest available data in respect of the world's telephones are shown in the tables and charts on the accompanying pages, taken from a bulletin recently issued by the Chief Statistician's Division of the American Telephone and Telegraph Company. Similar bulletins have appeared each year since 1912, with the exception of the war years during World Wars I and II. The current issue, presenting data generally as of January 1, 1946, is necessarily restricted in scope, owing to conditions resulting from the recent war. As data concerning plant destruction or subsequent restoration are not available for many of the belligerent nations, allowance has been made for these factors in estimating continental totals.

The United States, with its telephone system operating wholly under private ownership, had 21 telephones for each 100 of the population, as compared with an average development of 2.2 telephones per 100 population for the entire world. Australia, France, Great Britain, Russia, and Sweden, which together comprise 12 percent of the world's population—or just about twice that of the United States—had, on the average, only three telephones per 100 population, or one-seventh of the telephone development ratio found in the United States. These countries reported the largest five telephone systems owned and operated by national governments.

The largest two urban telephone centers are still those of New York and Chicago, with 2,002,310 and 1,204,525 telephones, respectively. These telephones exceed in the aggregate the total number of telephones in Asia, Africa, and Oceania combined, even though these continental areas account for more than 60 percent of the world's population. In addition to New York, there are six cities of the United States, each with more than one million population, which have in total well over three and a half million telephones: more than all the telephones serving our good neighbors in the Western Hemisphere.

In foreign countries the telephones are mainly concentrated in large urban centers. In the United States, on the other hand, on January 1, 1946, the total telephone development for each 100 persons in communities having a population of *less* than 50,000 was 16. No one city in the United States contains as much as 8 percent of the total number of the nation's telephones, whereas the capital cities of Belgium, Denmark, and France each contain about one-third of their country's telephones. Over 29 percent of all telephones in Norway are in Oslo, while more than one-quarter of those of Sweden are in the Stockholm area.

San Francisco, with a density of 43.3 telephones for each 100 inhabitants, has a higher telephone development than any other city in the world. Among the large foreign cities, only Stockholm, with a development of 38.4 telephones for each 100 of the population on January 1, 1945, can approach San Francisco's leadership, telephonically speaking.

(Continued on page 184)

TELEPHONE STATISTICS OF THE WORLD

LATEST AVAILABLE DATA

Countries	Date of Statistics	Telephones		Telephone Wire		Telegraph Wire		Conversations		Telegrams		Telephones in Large Cities		
		Thousands	Per 100 Pop.	Thousands of Miles	Per 100 Pop.	Thousands of Miles	Per 100 Pop.	Thousands	Per Avg. Capita	Thousands	Per Avg. Capita	Exchange Area	Telephones Thousands	Per 100 Pop.
NORTH AMERICA:														
United States	Jan. 1, 1946	27,867.0	21.0	110,700	83.5	2,260	1.7	36,765,000	284.5	235,000	1.8	New York City*	2,002.3	27.8
Canada	Jan. 1, 1944	1,692.2	14.4	6,058	51.6	379	3.2	2,980,000	254.7	15,650	1.3	Montreal (1-1-46)	242.8	20.5
Mexico	Jan. 1, 1946	217.0	1.0	885	4.1	—	—	575,000	26.8	—	—	Mexico City	117.3	6.8
Cuba	Jan. 1, 1946	81.1	1.6	341	6.8	15	0.5	463,000	93.2	—	—	Havana	58.0	8.1
Puerto Rico	Jan. 1, 1946	25.8	1.3	76	3.7	—	—	58,000	28.5	—	—	—	—	—
Total	Jan. 1, 1946	30,100.0	15.4	—	—	—	—	—	—	—	—	—	—	—
SOUTH AMERICA:														
Argentina	Jan. 1, 1946	571.0	4.0	3,050	21.3	165	1.2	—	—	—	—	Buenos Aires (1-1-45)	346.7	9.7
Bolivia	Jan. 1, 1945	7.6	0.2	15	0.4	9	0.3	—	—	—	—	—	—	—
Brazil	Jan. 1, 1943	331.0	0.8	1,360	3.2	114	0.3	1,700,000	40.3	—	—	Rio de Janeiro	131.4	6.6
Chile	Jan. 1, 1946	109.5	2.0	382	7.1	—	—	369,000	68.8	—	—	Santiago	59.4	5.9
Colombia	Jan. 1, 1944	47.1	0.5	200	2.0	—	—	—	—	—	—	Bogota	16.5	4.1
Ecuador	Jan. 1, 1945	8.6	0.3	10	0.3	7	0.2	—	—	—	—	Quito	3.8	2.2
Paraguay	Jan. 1, 1945	4.2	0.4	11	1.0	4	0.3	—	—	—	—	—	—	—
Peru	Jan. 1, 1946	39.6	0.5	138	1.8	18	0.2	—	—	—	—	Lima (1-1-45)	26.1	4.7
Uruguay	Jan. 1, 1942	57.8	2.7	187	8.6	7	0.3	160,000	73.5	—	—	Montevideo	42.1	5.9
Venezuela	Jan. 1, 1942	36.1	1.0	120	3.3	8	0.2	214,000	58.6	—	—	Caracas	25.8	8.1
Guianas	Jan. 1, 1946	3.6	0.6	10	1.7	—	—	—	—	—	—	—	—	—
Total	Jan. 1, 1946	1,290.0	1.3	—	—	—	—	—	—	—	—	—	—	—
EUROPE:														
Belgium	Jan. 1, 1946	379.6	4.5	—	—	—	—	289,000	34.3	—	—	Brussels	138.7	13.7
Bulgaria	Jan. 1, 1946	44.9	0.6	—	—	—	—	—	—	—	—	—	—	—
Denmark	Jan. 1, 1946	567.3	14.2	1,630	41.0	—	—	960,000	241.7	—	—	Copenhagen	265.5	26.3

Eire	Jan. 1, 1946	55.1	1.9	194	6.6	20	0.7	56,000	19.0	2,607	0.9	Dublin	31.7	6.5
Finland	Jan. 1, 1946	243.7	6.2	—	—	—	—	—	—	—	—	—	—	—
France	Jan. 1, 1946	1,879.5	4.7	—	—	—	—	1,358,000	34.2	40,312	1.0	—	—	—
Great Britain	Mar. 31, 1945	3,925.0	8.2	18,500	38.5	—	—	—	—	—	—	—	—	—
Hungary	Jan. 1, 1944	256.9	1.7	580	3.9	—	—	340,000	22.8	—	—	—	—	—
Norway	Jun. 30, 1944	327.0	10.9	974	32.4	13	0.4	433,000	144.5	7,717	2.6	Oslo (6-30-45)	95.6	22.0
Portugal	Jan. 1, 1946	97.7	1.2	210	2.6	—	—	—	—	—	—	Lisbon	42.0	5.7
Russia	Jan. 1, 1939	1,272.5	0.8	2,000	1.2	—	—	—	—	—	—	Moscow (1-1-36)	144.7	3.5
Spain	Jan. 1, 1946	447.2	1.6	1,141	4.2	—	—	997,000	36.8	—	—	Madrid	95.4	7.9
Sweden	Jan. 1, 1945	1,168.1	17.7	3,929	59.6	8	0.1	1,596,000	243.3	6,000	0.9	Stockholm	310.5	38.4
Switzerland	Jan. 1, 1946	645.4	14.7	1,950	44.3	27	0.6	543,000	124.0	2,295	0.5	Zurich	102.6	27.4
Total	Jan. 1, 1946	16,980.0	2.9	—	—	—	—	—	—	—	—	—	—	—
ASIA:														
British India	Jan. 1, 1946	118.6	0.03	776	0.2	413	0.1	—	—	—	—	Calcutta (3-31-45)	28.5	1.3
Total	Jan. 1, 1946	1,500.0	0.1	—	—	—	—	—	—	—	—	—	—	—
AFRICA:														
Union of South Africa	Mar. 31, 1946	275.0	2.5	1,165	10.4	19	0.2	380,000	34.1	9,513	0.9	Johannesburg	72.1	11.0
Total	Jan. 1, 1946	430.0	0.2	—	—	—	—	—	—	—	—	—	—	—
OCEANIA:														
Australia	Jun. 30, 1944	799.7	10.9	3,670	50.2	200	2.7	715,000	98.4	34,721	4.8	—	—	—
Hawaii	Jan. 1, 1946	69.0	13.8	201	40.3	—	—	—	—	—	—	Honolulu	39.1	18.2
New Zealand	Mar. 31, 1946	265.8	15.6	—	—	—	—	—	—	—	—	—	—	—
Total	Jan. 1, 1946	1,200.0	1.1		—	—	—	—	—	—	—	—	—	—
TOTAL WORLD	Jan. 1, 1946	51,500.0	2.2	—	—	—	—	—	—	—	—	—	—	—

NOTES: The above statistics incorporate the most recent information available on August 31, 1946. Totals for the world and geographical areas are partly estimated.

* The telephone development (telephones expressed in thousands) of other representative cities in the United States was, on January 1, 1946:

Chicago, Ill.	1,204.5	telephones, or	34.5	per	100	population	Milwaukee, Wis.	215.6	telephones, or	27.2	per	100 population
Los Angeles, Cal.	591.0	"	" 32.4	"	"	"	Minneapolis, Minn.	198.2	"	" 35.8	"	" "
Cleveland, Ohio	375.0	"	" 31.2	"	"	"	Seattle, Wash.	190.3	"	" 33.2	"	" "
Washington, D. C.	364.4	"	" 39.9	"	"	"	Denver, Col.	134.7	"	" 36.4	"	" "
San Francisco, Cal.	344.0	"	" 43.3	"	"	"	Hartford, Conn.	90.8	"	" 33.8	"	" "
Boston, Mass.	232.0	"	" 33.2	"	"	"	Omaha, Neb.	84.3	"	" 31.2	"	" "

Notes on Mobile Radio Service

H. I. Phillips

Wife—Central, can you get me my husband? He's out somewhere in his car.

Central—What's the number?

Wife—He's Wesley Finch and he drives a Buick roadster.

Central—I'll have to have the number.

Wife—I can't recall the number, but it's a blue car with red wheels and . . .

Central—You'll have to look in the auto-to-home phone book.

Wife—But we didn't get a book yet. It's not my fault if the company is so slow. The name is Wesley Finch, and it's a Buick with one front headlight bent. There's a cute little squirrel tail on the radiator.

Central—Sorry. I can't put through a home-to-car call that way.

Wife—Is that so? Well, we just paid $22 to have that phone put in and it's too bad if the company can't give us a little coöperation. . . .

Central—Do you wish "Information?"

Wife—What for? She wouldn't be out in the car with Wesley, would she? . . . Oh, here it is! . . .I just found the number on a desk pad . . . It's 78 & 4½ anti skid white walls. . . .No, that must be the tire number. . . .

[Ultimately the wife gets the number and gets the call through.]

Wesley (going around a curve)—Yes. Hello. Aw nuts! Why doncha look where ya going, ya big stumblebum.

Wife—Why Wesley!

Wesley—Hello, who's this? Scram, ya fathead! Nobody crowded ya!

Wife—Wesley! Such language! This is Mollie.

Wesley—Oh, hello, Mollie. Oh yeah? You and who else? Gwan go jump in the lake.

Wife—Don't you talk to me like that, Wesley Finch!

Wesley—Sorry, Mollie, dear. I wasn't talking to you. A big bum just gave me some lip. Go on honey. Have any trouble getting me?

Wife—Trouble! I could get you easier if you were in a runaway balloon. Look, I forgot to tell you this morning that Mr. and Mrs. Bunny—

Wesley—What missing money? Louder! There's a truckload of junk behind me and one of those 1926 Model T's ahead.

Wife—I say I forgot to tell you about Mr. and Mrs. Bunny who . . .

[There is now no answer. She jiggles the hook.]

Central—Number?

Wife—I had my husband on the phone but you cut us off.

Central—I didn't cut you off. He must have detoured.

Wife—Wesley wouldn't detour in the midst of a conversation.

Wesley (suddenly)—Here I am, honey. I just went through a tunnel.

Motor Cycle Cop (pulling up unobserved)—Hey, you. Pull over!

Wesley—This is very rude of you, officer. Cancha see, I'm busy on the telephone!

From the SUN DIAL. Reprinted by courtesy of the *New York Sun*.

Harold S. LeDuc

James R. McGowan

Who's Who and What's What

(Continued from page 131)

A. T. & T. in 1943. In September of 1945 he was released from military service as Major General and Chief, Procurement and Distribution Service, Signal Corps, and was re-elected to his position as Vice President, Department of Operation and Engineering, A. T. & T. Company. Among the many forms of recognition which have been bestowed upon him may be mentioned the recent awards of the Distinguished Service Medal by the War Department; of the Most Excellent Order of the British Empire, degree of Honorary Commander; and of the Hoover Medal for Distinguished Public Service.

IF LEON W. GERMAIN exhibits a considerable degree of familiarity with telephone cables, their capabilities and their vagaries, it is probably because he has been working with them during most of his Long Lines career—and that began in 1909. By 1911 he was cable tester on the Boston-Washington duplex cable project—the first of its kind—and in 1914 he went to Chicago as chief cable tester on the Chicago-Highland duplex toll entrance project. He was subsequently division plant engineer, general plant supervisor, and division plant superintendent in several parts of the country. After 10 years as general plant superintendent of Long Lines' western area, Mr. Germain was appointed General Plant Manager of the Long Lines Department in 1940.

THE "saturation" advertising to which HAROLD S. LEDUC refers in his article *Philadelphia Goes "2–5"* is primarily a cant expression, but the word does not greatly exaggerate the accomplishment. For it is no secret around Philadelphia that the operating departments of the Bell Telephone Company of Pennsylvania credit the campaign which Mr. LeDuc describes with much of the success of a major undertaking which was put across with a minimum of difficulty. Entering the General Information Department of the Pennsylvania company in 1926 as advertising assistant, he progressed through the public relations functions to become general advertising manager in 1941, and Vice President—Pubblic Relations last October, succeeding Peter L. Schauble.

AFTER BEING ABSENT from these pages since 1944, Telephone and Telegraph Statistics of the World put in a welcome ap-

pearance again, this time under the appropriate title of *Telephones in the Post-War World* and from the sharply pointed pencil of JAMES R. MCGOWAN. Recently back with the Chief Statistician's Division at A. T. & T., Mr. McGowan spent more than four years of military duty with the Signal Corps in statistical and administrative work in Washington and with the Economics Division of Military Government in Berlin. During his nine years of Bell System service he has been busy with the statistics and economics relating to foreign telephone development.

IT IS *rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion. . . .*

Those words of Abraham Lincoln are as full of meaning today as when they were first spoken at Gettysburg 83 years ago. We offer his immortal thought, this Armistice Day, both in tribute to our fighting men of World Wars I and II and as a prayer for lasting peace.

We in the Bell System know what war means. During the first world war, there were 24,900 stars in our service flag, and 276 of them were gold stars.

In World War II, 69,100 Bell System men and women served in the armed forces, and 1339 gave their lives. Throughout our organization are many who served in *both* wars.

So we pause tonight for a moment of grateful tribute to them—and to veterans everywhere—who took up arms to defend the faith, ideals, and integrity of our country.

From the Telephone Hour radio program of November 11, 1946